APPENDIX A

SAMPLE DESIGN

This appendix provides a justification for the sampling sizes and the sampling protocol employed in the project.

A.1.5 AMPLE SIZE JUSTIFICATION

One approach for using the survey information requires that many of the parameters to be estimated in this study be treated as proportions--for example, the proportion of adults who participate in water-related recreation activities. Accordingly, the proposed sample sizes were determined by computing the sample size required to estimate proportions of the underlying population (i. e., households in the Monongahela River basin).

The required sample size depends upon the desired precision of the proportion estimates. The sample size required to produce an estimate, $\hat{p}$, within δ units of the true population proportion, p, with α percent certainty depends upon δ, p, and α. Obviously, it is desirable to make δ small and α large. However, decreasing δ and increasing α each requires an increase in the required sample size. Additionally, a δ value considered precise for large p values is not necessarily precise for small p values. For example, let δ = 0.10, $\hat{p}_1$ = 0.85, and $\hat{p}_2$ = 0.05. Then, $\hat{p}_1 \pm \delta$ is equal to 0.85 ± 0.10, which is relatively precise. However, $\hat{p}_2$ ± 6, which is equal to 0.05 ± 0.10, is not very precise.

Table A-1 shows the sample sizes needed to detect a specific difference with power 1 - β. The crucial specific differences for this project were those in estimated values for the willingness to pay for different levels of water quality and differences in estimates of option and existence values for the Monongahela River.

An example using estimated coefficients of variation (which are equal to the standard error of the estimate divided by the mean estimate, or simply a method of comparing the variation in the measured benefits) from related studies, shown in Table A-2, will explain Table A-1. If the coefficient of variation is equal to 0.2 (as was the case in the Walsh et al. [1978] South Platte River Basin Study for Denver residents' willingness to pay for existence values), a sample size of 68 is necessary to detect a 10 percent difference in the mean value with 95 percent confidence that the difference is different from zero and a lo-percent chance of not rejecting the null hypothesis (Δ = 0) when it is false. If there is little or no variation in the estimates, small differences can be detected with minimal sample size. However, considerable variation in estimated values will mean that the sample size at 384 may not be able to detect small differences in the estimates. Thus, when proportions are estimated,

Table A-1. Sample Sizes Needed to Detect a Specified Difference With Power $1 - \beta$

Detection level (A)	CV = coefficient of variation (σ_e/μ_c)[a]				
	0.1	0.2	0.3	0.4	0.5
			(a) α = Type I error = 0.05, β = Type II error = 0.1		
$0.06\ \mu_c$	48	190	428	760	1,189
$0.08\ \mu_c$	27	107	241	428	669
$0.10\ \mu_c$	17	68	154	274	428
$0.15\ \mu_c$	8	30	68	122	190
$0.20\ \mu_c$	4	17	39	68	107
$0.25\ \mu_c$	3	11	25	44	68
			(b) $\alpha = 0.05$, $\beta = 0.25$		
$0.06\ \mu_c$	30	120	269	478	748
$0.08\ \mu_c$	17	67	151	269	421
$0.10\ \mu_c$	11	43	97	192	269
$0.15\ \mu_c$	5	19	43	77	120
$0.20\ \mu_c$	3	11	24	43	67
$0.25\ \mu_c$	2	7	16	28	43

[a] σ_e is the common standard deviation for both the treatment and control responses under the model, and μ_c is the mean response (usage level) for the control. The sample size is calculated as $n = 2(CV/\Delta)^2(z_{1-\alpha} + z_{1-\beta})^2$, where z is the standard normal variate.

relative precision is often considered as the most appropriate basis for determining sample size. This is accomplished by requiring that $\hat{p}$ lie within $p\delta$ units of the true p value with *a* percent certainty for smallest proportion of interest. In the above example, the estimate of the small p value would change from 0.05 ± 0.10 to 0.05 ± 0.005, which is a much more precise estimate. Obviously, this method significantly increases the required sample sizes for small p values.

Table A-3 contains minimum sample sizes for $\hat{p}$ to be within $p\delta$ units of p with 95 percent certainty (in the sense of repeated sampling) for various values of p and δ, assuming simple random sampling. The p values to be estimated in the study are unknown and will probably vary considerably from one activity to another. Therefore, it is impossible to determine exactly the appropriate sample size. Based on past work it is reasonable to assume that

Table A-2. Coefficients of Variation for Selected Benefits Estimates

Study 1[a]			Study 2[b]			Study 3[c]		
Measured benefit	CV	η	Measured benefit	CV	η	Measured benefit	CV	η
Beatable water quality	0.05	748	Existence value (user)	0.20	88	Aesthetic and health	0.38	10
Fishable water quality	0.05	748	Existence value (user)	0.33	88	Aesthetic and health	0.34	10
swimmable water quality	0.0s	748	Existence value (nonuser)	0.63	15	Aesthetic and health	0.43	9
			Bequest value (nonuser)	0.93	15	Aesthetic and health	0.05	7
						Aesthetic and health	0.61	8

[a]See Mitchell and Carson [1981].
[b]See Walsh et al. [1978].
[c]See Brookshire et al. [1979].

Table A-3. Required Sample Size for Estimates of p to be Within pδ Units of p, Assuming Simple Random Sampling

p \ δ	0.05	0.10	0.15	0.20	0.25
0.01	152,127	38,032	16,903	9,508	6,085
0.05	29,196	7,299	3,244	1,825	1,168
0.10	13,830	3,457	1,537	864	553
0.25	4,610	1,152	512	288	184
0.35	2,854	713	317	178	114
0.40	2,305	576	256	144	92
0.50	1,537	384	171	96	61
0.75	512	129	57	33	21
0.95	81	21	9	6	4

most p values will be in the range of 0.35 to 0.40 or higher. Ditton and Goodale [1973] found that 69.2 percent of the residents in the Green Bay, Wisconsin, area had engaged in water-related outdoor recreation within the last year. The 1977 outdoor recreation survey conducted by the Department of the Interior determined that, with this assumption, a reasonably precise estimate can be formed by requiring that δ = 0.20 (i.e. , $p\delta$ = (0.35)(0.20) = 0.07 or $p\delta$ = (0.40)(0.20) = 0.08). These values of p and δ produce a required sample size in the range of 144 to 178. These estimates are based on simple random sampling and need to be increased because of the effects of a cluster sample design. That is, the area sampling design requires expansion of the recommended sample size. The recommended sample size also assumed a 20-percent nonresponse rate. It should be recognized that the proposed sample size will give less precise estimates for p values below the 0.35 to 0.40 range and more precise estimates for p values above the range. Since the coefficients of variations for p shown in Table A-1 are approximately one and one-half times larger than the coefficients of variations in Table A-2, the recommended sample size should yield adequate power for detecting differences in the willingness to pay and option and existence values.

A.2 SAMPLING PROTOCOL

Using 1970 census computer data tapes (more up-to-date data were not available at the time of the study since the 1980 census computer data tapes had not been released) for Enumeration Districts and Block Groups (ED/BGs), noncompact clusters of approximately seven households were constructed. The 1970 data were adjusted by county using preliminary 1980 census data to more accurately reflect the present. Additionally, the 1970 occupancy rate and the estimated response rate were taken into account in determining the cluster size.

The clusters were constructed into three groups once they were stratified. The groups are those households in (1) Pittsburgh, (2) a place other than Pittsburgh, and (3) not in a place. Fifty-one clusters were selected. The number of clusters selected from each stratum were proportional to the number of households in that stratum. For example, since 61 percent of the households in the five-county area are located in Pittsburgh, 51(0.61) = 31 clusters were selected from Pittsburgh. The clusters were selected with equal probabilities within each stratum. Because of the proportional allocation of the sample to the strata, the probabilities of selection for all clusters were nearly equal.

Because the clusters were contained in ED/BGs, the general physical location of the cluster is known. Interviewers were sent to the field to count and list all households in the ED/BGs that contain the selected clusters. The lists produced during the counting and listing exercise were used to identify the specific households in the selected cluster. If the number of households did not exceed a predetermined number, all households in the cluster were contacted. For those clusters that were too large, the list was used to determine a subsample of the cluster to be contacted.

Once the households to be contacted were identified, the interviewers conducted a preliminary visit and compiled a roster of all adults living in the household. One of the adults was randomly selected (with equal probabilities) for interview.

APPENDIX B

SURVEY FORMS AND PROCEDURES

PART 1

HOUSEHOLD CONTROL FORM

Part 1 of this appendix contains the household control form used by field interviewers to provide assignment and other background information.

Estimating Benefits of Water Quality
RTI Project No. 41U-2222-2

OMB No. 2000-0381
Approval Expires: 9/30/82

HOUSEHOLD CONTROL
Form No. 01

I. ASSINGMENT INFORMATION

A. Study No. 2 2 2 2 2 (1-5) B. PSU/Segment No. ☐ - ☐☐☐☐☐ (7-12) C. Housing Unit No. ☐☐☐ (14-16) D. Interviewer No. ☐☐☐☐☐☐

B. Address ____ (Number/Street/RFD) ____ (Apartment No.) ____ (City) ____ (State) ☐☐☐☐☐ (Zip)

II RECORD OF CONTACTS - ENUMERATION AND SAMPLE INDIVIDUAL

Day of Week	Date	Time	Notes	Result Code	FI
		am pm			
		am pm			
		am pm			
		am pm			
		am pm			
		am pm			
		am pm			
		am pm			

III. CONTACT RESULT CODES (CIRCLE BELOW THE FINAL RESULT CODE FOR EACH TYPE OF CONTACT)

Household Enumeration Contact Codes

01 Enumeration Completed
02 No Enumeration Eligible at Home
03 Enumeration Respondent Breakoff; Partial Data
04 Enumeration Respondent Refused
05 Language Barrier
*06 Vacant Housing Unit
*07 Not a Housing Unit; e.g., Merged, Demolished, Group Quarters, Non-Residential
08 Other (EXPLAIN IN "COMMENTS")
(18-19)

Sample Individual Contact Codes

20 Interview Completed (CIRCLE VERSION ADMINISTERED IN SECTION VI. N)
21 Appointment Made
22 Interview Breakoff; Partial Data
23 Sample Individual not Home
24 Refusal
25 Language Barrier
26 Other (EXPLAIN IN "COMMENTS")
(21-22)

IV. *Source of Information for Result Codes 06, 07

Name ____

Number/Street/RFD ____

City/State/Zip ____

( ) ____
Telephone Number

V. COMMENTS

____

VI. HOUSEHOLD ENUNERATION ANI) SAMPLE INDIVIDUAL SELECTION

Hello, I'm (NAME) with the Research Triangle Institute of North Carolina. We are doing a household survey for a government agency to study levels of water quality and some outdoor recreational activities people take part in both near and on ponds, lakes, streams, and rivers in the Pittsburgh area. Your household has been randomly selected along with other's in this area to he interviewed. In order to determine who in your household should be interviewed, I would like to ask a few questions shout the residents of your household. I am required to talk with a household member who is 16 years of age or older. (ASK IF NECESSARY, ARE YOU 16 YEARS ON OLDER?)

1. **First, are there any occupied or vacant living quarters other than your own (FOR SINGLE UNIT STRUCTURE) in this structure or on this property? (FOR MMULTI-UNIT STRUCTURES?) in this unit?**

   (CIRCLE NUMBER BELOW FOR RESPONSE)

   1 **YES (ADD TO LIST OF ADDED HOUSING UNITS IF REQUIRED BY MISSED HU RULES)**

   2 **NO**

2. **Now, I would like to ask some general questions about you and all of the other people who live in this household, including friends and roomers. Let's list the people who live here in order of age, beginning with the oldest first. (ENTER AGES IN DESCENDING AGE ORDER IN COLUMN B.) I have listed ages for persona who are (READ AGES). Is there anyone else living here now? (It' YES, ENTER AGE(S) AND CORRECT AGE ORDER IN COLUMN U, IF NECESSARY)**

3. **ASK THE SEX FOR EZCH PERSON LISTED AND CIRCLE THE CORRECT CATEGORY IN COLUMN C.**

4. **Which person ia the head of the household? (WRITE THE WORD "HEAD" IN COLUMN D FOR THE LJNE NUMBER OF THE PERSON CONSIDERED THE READ OF HOUSEHOLD)**

5. **FOR OTHER PERSONS LISTED ASK THEIR RELATIONSHIP TO TRE HEAD OF HOUSEHOLD AND ENTER IN column D.**

6. **SELECT THE HOUSEHOLD MEMBER TO BE INTERVIEWED FROM AMONG ONLY HTOSE PERSONS 18 YEARS OR OLDER (ELIGIBLE HOUSEHOLD MEMBERS . REFERRING TO THE AGES LISTED IN THE ROSTER, DETERMINE THE NUMBER OF PERSONS WHO ARE 18 YEARS OR OLDER AND DRAW A LINE ACROSS THE ROSTER TO SEPARATE THOSE PERSONS FROM THOSE 17 OR YOUNGER. LOCATE ON THE TABLE BELOW THE ROSTER TNE NUMBER OF ELIGIBLE HOUSEHOLD MEMBERS . DIRECTLY BELOW THE NUMBER OF HOUSEHOLD MEMBERS , FIND THE ROSTER LINE NUMBER SELECTED. CIRCLE THE SELECTED LINE NUMBER ON THE ROSTER .**

7. **(You have/~~~$~N has) been selected as the person to be interviewed. (ASK FOR THE NAME OF THE PERSON SELECTED AND ENTER WERE)** ____________________

   PRINT NAME OF SELECTED INDIVIDUAL

   IF ENUMERATION RESPONDENT HAS BEEN SELECTED, ATTEMPT TO COMPLETE INTERVIEW. IF ANOTHER PERSON , DETERMINE IF HE/SHE IS AVAILABLE OK WHEN HE/SHE WILL BE.

8. **QUESTIONNAIRE VERSION ADMINISTERED (CIRCLE VERSION) A B C D**

   (/4 CAl !)

HOUSEHOLD ROSTER

A	B AGE.	C SEX M - - F	D	CARD 2 1 - 16 DUP FROM CARD 1 COL. 80 - 2
		1 2		
01		1 2		(19-23)
02		1 2		(24-28)
03		1 2		(29-33)
04		1 2		(34- 38)
05		1 2		(39-43)
06		1 2		(44-48)
07		1 2		(49-51)
08		1 2		(54-58)
09		1 2		(59-63)
10		1 2		(64-68)
11		1 2		(69-73)

26-27)

CARD 1.
COL. 80 = 1

HOUSEHOLD SIZE:

ON THE	1	2	3	4	5	6	7	8	9	10	11
RESPONDENT NO. :	1	1	1	4	4	3	4	5	8	1	9

PART 2

COUNTING AND LISTING EXAMPLES

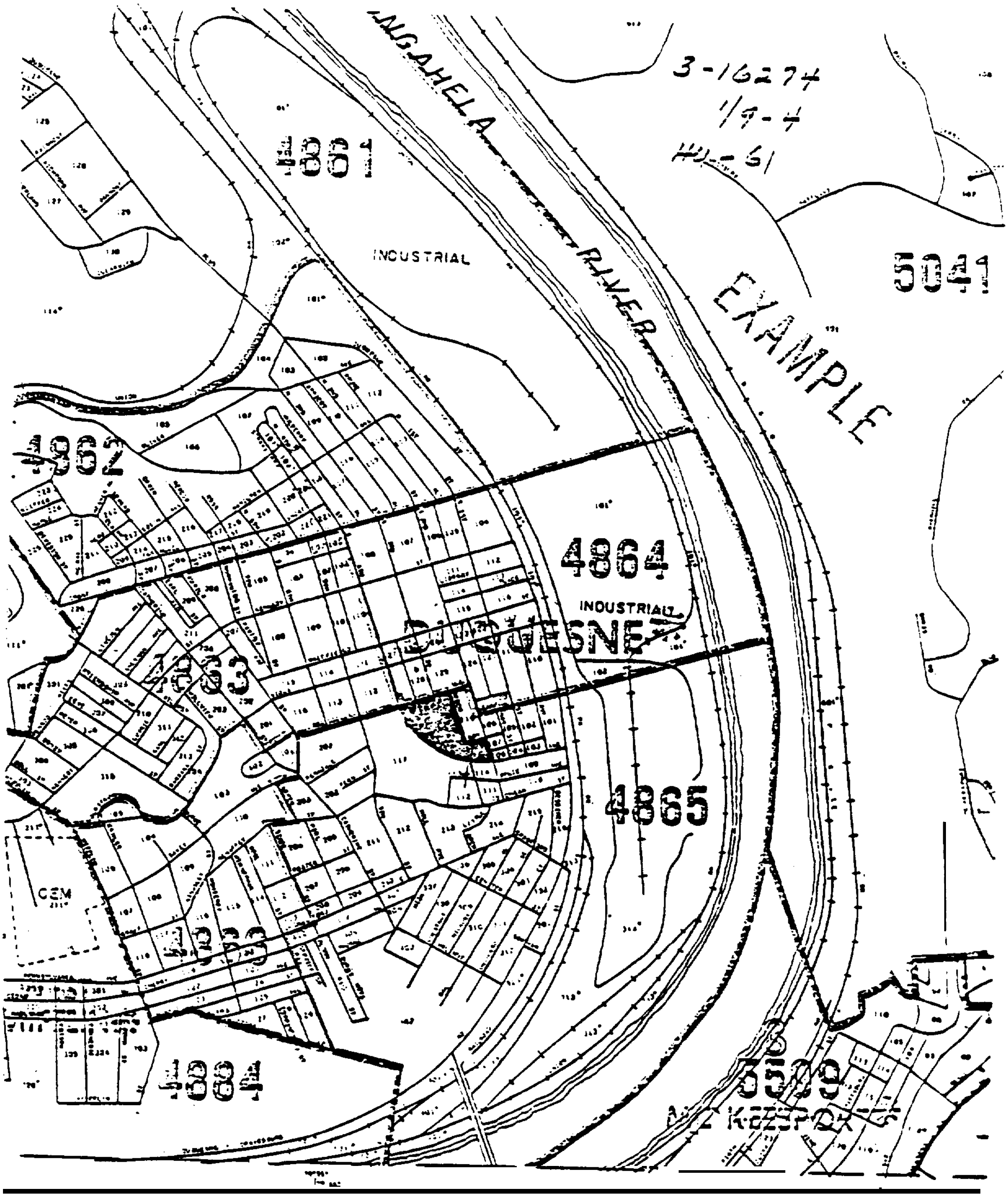

Figure B-1. Sample segment map.

SEGMENT ID 3-16274 PLACE DUQUESNE, PA

PREPARED BY N. EPPLER DATE 10/26/81

REVIEWED BY ______ DATE ______

Indicate North

↑

EXAMPLE

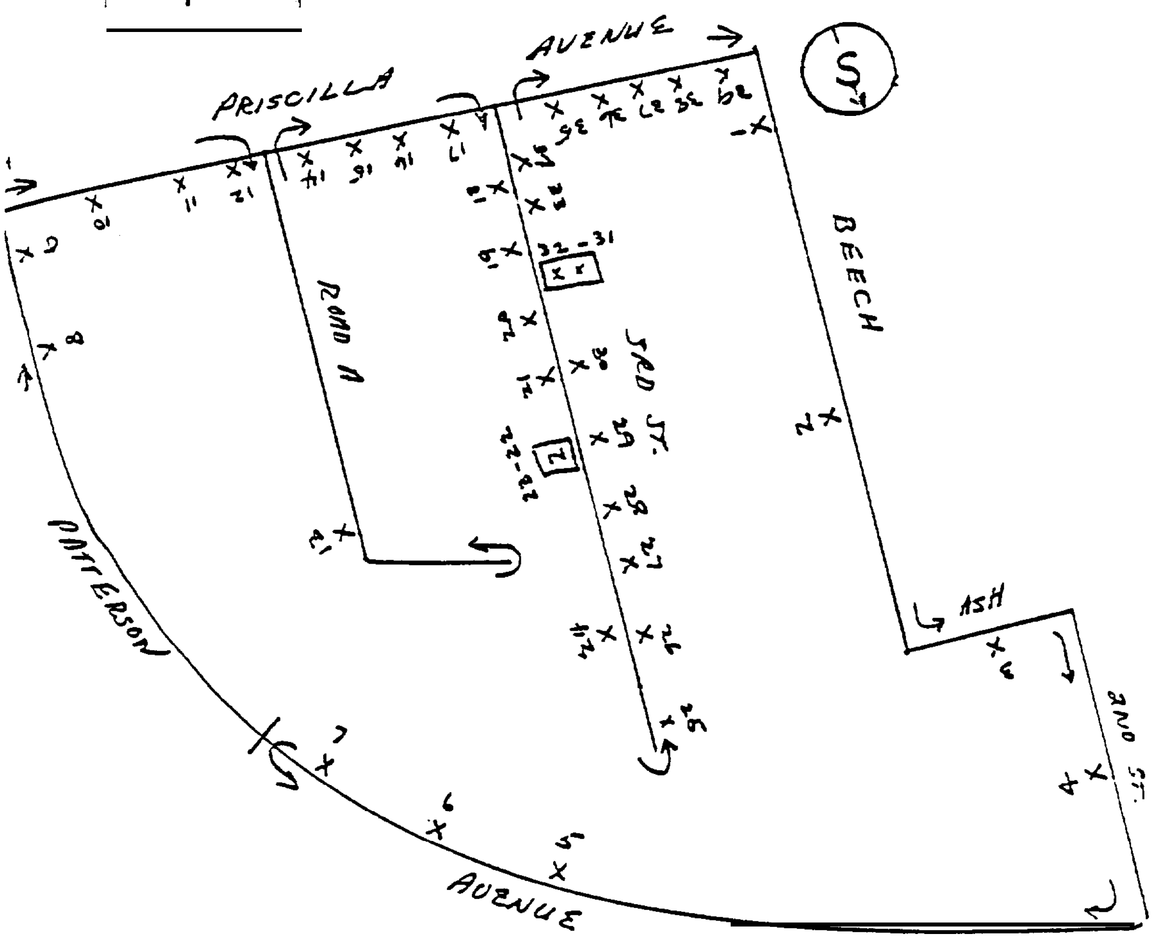

Figure B-2. List unit sketch.

SAMPLE

LIST OF HOUSING UNITS

Date Listed 10 / 26 / 81
(Month) (Day) (Year)

Listed By N EPPLER / L SARGELL

ID No. 320267

Segment No. 3-16276 Part No. ______

1 HU No.	2 St. No.	3 Street Name	4 Apt. No.	5 Housing Unit Description	6 Apt. Location
1	407	BEECH ALLEY			
2	417	" "			
3		ASH		GREY SIDING - WH. TRIM	
4	438	2ND ST			
5	210	PATTERSON AVE			
6		"		GREY SIDING - WH SHUTTERS	
7	220			GREY INSULBRICK GR. TRIM	
8		4th ST		GREY INSULBRICK BL. PILLARS	
9	409	"			
10		PRISCILLA		ABOVE SLOVAK CIVIC FED	
11	315				
12	313				
13	307	ROAD A		NEWBY	
14		PRISCILLA		YELLOW ½ PAINTED FRAME	
15	309				
16	307				
17	400			INSUL BRICK - REAR ENTRANCE	
18	402	3RD ST			
19	406				
20	410				

Post Office DUQUESNE PA Zip Code 15110 HU 1 - 39
(City) (State)

Post Office ______ Zip Code ______ HU ___ - ___
(City) (State)

Post Office ______ Zip Code ______ HU ___ - ___
(City) (State)

Checked By ______

Figure B-3. List of housing units.

PART 3

DEBRIEFING AGENDA

Part 3 of this appendix contains the agenda used during the December 1981 interviewer debriefing session.

Estimating Recreation and Related Benefits of Water Quality
RTI Project 2222-2

DEBRIEFING AGENDA

Thursday, December 10, 1981

<u>welcome and Introductions</u>

<u>Evaluation of Training</u>

- Effectiveness of home study materials
- Effectiveness of classroom sessions
- Adequacy of training time
- Areas encountered in interviewing that should have been covered in training
- Usefulness of specifications and manual
- Deficiencies in specifications and manual

<u>Evaluation of Assignment Materials and Procedures</u>

- Content and layout of Household Control Form
- Accuracy of sample member assignment data (names, addresses, etc.)
- Tracing/locating activities required
- Deficiencies in materials and procedures

<u>Obtaining Respondent Cooperation</u>

- Gaining access to sample members
- Explaining purposes of the survey
- Obtaining permission to complete enumeration
- Obtaining permission to complete the interview
- Intervention by other household/family members
- Effectiveness of " Dear Resident" and other informational material
- Characteristics of nonrespondents and reasons for nonresponse
- Procedures for converting refusing sample members

Conducting the Interviews

- Household enumeration procedures and problems

  Usefulness of handout materials

  Deficiencies of handout materials

- Section-by-section review of all questionnaires

  (1) What questions usually worked well and were understood by all respondents?

  (2) What questions frequently were difficult to administer or were misunderstood by respondents?

  (3) What questions appeared to elicit reliable responses with minimal probing?

  (4) What questions frequently yielded "Don't Know" responses?

  (5) What questions were respondents reluctant to answer? What reasons, if any, were stated?

  (6) What category of respondents (i. e., disabled, widowed, older men, etc.) had the most difficulty in responding to the questions?

  (7) What category of respondents were most reluctant to answer certain questions?

- Problems with layout or design of each instrument

  Problems in the interview setting

  Problems with interview length

  Questions or concerns expressed by respondents

Administrative Procedures

- Status reporting

  Communications with supervisor/central office

  Resolution of field problems

  Evaluation of callback requirements

Recommendations for Future Similar Surveys

  Respondent informational material

  Assignment materials and procedures

- Contacting, locating, and securing cooperation

  Instruments and handouts

- Administrative materials and procedures

PART 4

QUALITY CONTROL PROCEDURES

The quality control procedures used during and after administration of the survey questionnaire, including both field editing and validation procedures, are described below:

FIELD EDITING

Field interviewers were responsible for conducting a thorouqh field edit of each completed survey instrument. Interviewers wer-e provided-with an edit instruction for the instruments to insure that significant edit checks were made. The importance of, the field editing process and procedures to be followed were emphasized in the interviewer's manual and received attention as part of interviewer training.

Field editing by interviewers involved two steps. First, each completed instrument was scanned for completeness at the conclusion of each interview while the interviewer was still in the respondent's presence. If any incomplete or omitted items were detected, the missing data were obtained. Second, interviewers thoroughly edited each completed instrument before submitting their work. Any omissions or problems noted during this edit were resolved by a telephone call or, if necessary, a return visit to the respondent by the interviewer. These field edit procedures were especially important as an aid to insure that high quality and complete data were received from the field.

To insure quality control of the interviewing process, each interviewer's completed interviews were edited at the Research Triangle Institute (RTI) during the fieldwork period. The editor used edit specifications that focus on the key elements of each document, and interviewers received ongoing assessments of the quality of their work by telephone. In addition, where graphic instruction to an interviewer was helpful to explain the nature of an error, photocopies were made of questionnaire pages to show interviewers exactly what the problem was.

VALIDATION

A major quality control procedure involved validation of a random sample of 10 percent of the interviews conducted. This procedure was accomplished through telephone contacts with participating sample members. The validation contact was designed to determine whether the interview actually took place on or about the date reported; whether the interviewer secured a complete, current household roster; whether appropriate sample member selection procedures were followed; and whether the entire interview schedule was completed. Also, key items were asked and responses compared with original responses reported by the interviewer. In addition, the contact elicited other information concerning the interviewer's performance.

APPENDIX C

SURVEY ANALYSIS: SUPPORTING TABLES

This appendix provides supporting statistical analysis for the option price, user value, and option value results presented in Chapters 4 and 5. The tables in general focus on three issues: (1) estimates with outliers excluded; (2) estimates with protest bids excluded; and (3) t-tests for differences from zero.

In addition, Table C-16 supports the analysis in Chapter 6. This table shows benefit estimates from an alternative contingent-ranking specification.

Table C-1. Student t-Statistics of Characteristics for $H : X_1 = x^*$[a]

Characteristic	User vs. nonuser	Zero vs. nonzero bids
Ownership or use of a boat	2.471[b]	-1.589
Participation in any outdoor recreation in the last year	10.746[b]	-4.818[b]
Numerical rating of the Monongahela	0.365	-1.369
Rating for a particular site	5.988[b]	-3.205[b]
Length of residence	0.242	0.167
Education	1.655	-2.031[b]
Race	-0.804	1.699
Income	1.124	-1.713
Age	-5.995[b]	4.942[b]
Sex	-1.338	-0.347

[a]t-statistics are derived from the results reported in Chapter 4.

[b]Denotes significance at the 0.05 level.

Table C-2. Estimated Option Price for Changes in Water Quality: Effects of Instrument and Type of Respondent--All Respondents[a]

Change in water quality	User $\bar{X}$	User s	User n	Nonuser $\bar{X}$	Nonuser s	Nonuser n	Combined $\bar{X}$	Combined s	Combined n
1. Iterative bidding framework--starting point = $25 (Version C)									
D to E (avoid)	21.7	18.6	24	23.7	32.9	54	23.1	29.2	78
D to C	15.0	16.4	24	11.9	15.6	54	12.9	15.8	78
C to B	9.4	13.7	24	5.7	10.7	54	6.9	11.7	78
D to B[b]	25.4	27.5	24	41.4	51.5	54	20.1	25.3	78
combined: all levels	47.1	41,8	24	17.7	24.1	54	43.1	48.5	78
2. Iterative bidding framework--starting point = $125 (Version D)									
D to E (avoid)	89.5	70.3	22	44.6	84.1	50	58.3	82.4	72
D to C	63.9	53.5	22	29.7	56.0	50	40.1	57.1	72
C to B[b]	41.8	54.2	22	19.9	51.1	50	26.6	52.6	72
D to B	111.8	94.4	22	51.3	102.1	50	69.8	103.1	72
Combined: all levels	201.4	149.8	22	95.9	177.6	50	128.1	175.5	72
3. Direct question framework (Version B)									
D to E (avoid)	42.6	67.8	23	13.5	35.2	51	22.5	49.2	74
D to C	27.9	42.7	23	9.3	22.3	51	15.1	31.1	74
C to B[b]	24.0	49.5	23	7.7	22.5	51	12.8	33.8	74
D to B	53.0	84.6	23	17.7	43.5	51	28.7	61.0	74
Combined: all levels	95.7	130.7	23	31.2	77.0	51	51.2	100.6	74
4. Direct question framework: payment card (Version A)									
D to E (avoid)	57.1	92.8	24	38.9	68.8	51	44.7	77.1	75
D to C	46.0	71.1	24	15.9	30.3	51	25.5	48.9	75
C to B[b]	22.5	45.3	24	5.6	17.3	51	11.0	30.1	75
D to B	70.6	112.5	24	21.7	42.5	51	37.3	75.4	75
Combined: all levels	127.7	159.4	24	60.6	96.1	51	82.1	123.0	75

[a]The two respondents who did not complete the questionnaire are excluded.

[b]D to B includes respondents who were willing to give an amount only for fishable or swimmable water and respondents who were willing to pay some amount to avoid the decrease in water quality in addition to the improvements in water quality.

Table C-3. Estimated Option Price for Changes in Water Quality: Effects of Instrument and Type of Respondent--Protest Bids Excluded

Change in water quality	User $\bar{X}$	User s	User n	Nonuser $\bar{X}$	Nonuser s	Nonuser n	Combined $\bar{X}$	Combined s	Combined n
1. Iterative bidding framework--starting point = $25 (Version C)									
D to E (avoid)	27.4	16.7	19	28.4	34.2	45	28.1	29.9	64
D to C	18.9	16.3	19	14.3	16.1	45	15.7	16.2	64
C to B	11.8	14.5	19	6.9	11.3	45	8.4	12.4	64
D to B[a]	32.1	27.1	19	21.2	25.0	45	24.5	25.9	64
Combined: all levels	59.5	38.1	19	49.7	52.7	45	52.6	48.7	64
2. Iterative bidding framework--starting point = $125 (Version D)									
D to E (avoid)	93.8	69.0	21	54.4	90.2	41	67.7	85.1	62
D to C	66.9	52.8	21	36.2	60.0	41	46.6	59.1	62
C to B	43.8	54.7	21	24.3	55.5	41	30.9	55.6	62
D to B[a]	117.1	93.3	21	62.6	109.8	41	81.0	107.0	62
Combined: all levels	210.0	146.4	21	117.0	190.1	41	148.8	180.9	62
3. Direct question framework (Version B)									
D to E (avoid)	51.6	71.7	19	18.6	40.3	37	29.8	54.7	56
D to C	33.8	44.9	19	12.8	25.4	37	19.9	34.4	56
C to B	29.1	53.3	19	10.6	25.9	37	16.9	38.0	56
D to B[a]	64.2	89.4	19	24.4	49.7	37	37.9	67.7	56
Combined: all levels	115.8	135.7	19	43.0	87.8	37	67.7	110.8	56
4. Direct question framework: payment card (Version A)									
D to E (avoid)	65.2	96.7	21	49.6	74.3	40	55.0	82.2	61
D to C	52.6	73.8	21	20.3	33.0	40	31.4	52.6	61
C to B	25.7	47.7	21	7.1	19.3	40	13.5	32.9	61
D to B[a]	80.7	117.1	21	27.6	46.3	40	45.9	81.3	61
Combined: all levels	146.0	162.6	21	77.3	102.6	40	100.9	129.3	61

[a]D to B includes respondents who were willing to give an amount only for fishable or swimmable water and respondents who were willing to pay some amount to avoid the decrease in water quality in addition to the improvements in water quality.

Table C-4. Estimated User Values for Changes in Water Quality: Effects of Instrument and Type of Respondent--All Respondents[a]

Change in water quality	Type of respondent					
	User			Combined		
	$\bar{X}$	s	n	$\bar{X}$	s	n
1. Iterative bidding framework--starting point = $25 (Version C)						
D to E (avoid)	5.2	11.5	24	1.6	6.7	78
D to C	3.3	7.0	24	1.0	4.1	78
C to B	4.0	7.4	24	1.2	4.4	78
D to B[b]	8.3	13.5	24	2.6	8.3	78
Combined: all levels	13.5	23.3	24	4.2	14.2	78
2. Iterative bidding framework--starting point = $125 (Version D)						
D to E (avoid)	38.0	58.9	22	11.6	36.5	72
D to C	31.1	50.0	22	9.5	30.8	72
C to B[b]	32.0	52.9	22	9.8	32.4	72
D to B	69.3	102.1	22	21.2	64.1	72
Combined: all levels	107.3	147.3	22	32.8	94.3	72
3. Direct question framework (Version B)						
D to E (avoid)	19.1	37.6	23	5.9	22.5	74
D to C	18.0	37.7	23	5.6	22.3	74
C to B[b]	11.9	31.6	23	3.7	18.2	74
D to B	29.9	62.3	23	9.3	36.9	74
Combined: all levels	49.0	81.9	23	15.2	50.4	74
4. Direct question framework: payment card (Version A)						
D to E (avoid)	20.2	35.0	24	6.5	21.7	75
D to C	30.2	73.2	24	9.7	43.2	75
C to B[b]	16.0	42.7	24	5.1	25.0	75
D to B	46.7	113.5	24	14.9	67.0	75
Combined: all levels	66.9	121.3	24	21.4	74.6	75

[a]The two respondents who did not complete the questionnaire are excluded.

[b]D to B includes respondents who were willing to give an amount only for fishable or swimmable water and respondents who were willing to pay some amount to avoid the decrease in water quality in addition to the improvements in water quality.

Table C-5. Estimated User Values for Changes in Water Quality: Effects of Instrument and Type of Respondent-- Protest Bids Excluded

Change in water quality	Type of respondent					
	User			Combined		
	$\bar{X}$	s	n	$\bar{X}$	s	n
1. Iterative bidding framework--starting point = $25 (Version C)						
D to E (avoid)	6.6	12.6	19	2.0	7.4	64
D to C	4.2	7.7	19	1.3	4.5	64
C to B	5.0	8.0	19	1.5	4.9	64
D to B[a]	10.5	14.4	19	3.1	9.1	64
Combined: all levels	17.1	25.1	19	5.1	15.6	64
2. Iterative bidding framework--starting point = $125 (Version D)						
D to E (avoid)	39.8	59.7	21	13.5	39.1	62
D to C	32.6	50.7	21	11.0	32.9	62
C to B	33.6	53.7	21	11.4	34.7	62
D to B[a]	72.6	103.4	21	24.6	68.6	62
Combined: all levels	112.4	148.9	21	38.1	100.7	62
3. Direct question framework (Version B)						
D to E (avoid)	23.1	40.4	19	7.8	25.6	56
D to C	21.8	40.6	19	7.4	25.4	56
C to B	14.4	34.4	19	4.9	20.9	56
D to B[a]	36.2	67.1	19	12.3	42.1	56
Combined: all levels	59.3	86.9	19	20.1	57,2	56
4. Direct question framework: payment card (Version A)						
D to E (avoid)	23.1	36.6	21	8.0	23.8	61
D to C	34.5	77.5	21	11.9	47.7	61
C to B	18.3	45.3	21	6.3	27.6	61
D to B[a]	53.3	120.2	21	18.4	73.9	61
Combined: all levels	76.4	127.1	21	26.3	82.0	61

[a]D to B includes respondents who were willing to give an amount only for fishable or swimmable water and respondents who were willing to pay some amount to avoid the decrease in water quality in addition to the improvements in water quality.

Table c-6. Estimated Option Values for Changes in Water Quality: Effects of Instrument and Type of Respondent--All Respondents[a]

Change in water quality	Type of respondent								
	User			Nonuser			Combined		
	$\bar{X}$	s	n	$\bar{X}$	s	n	$\bar{X}$	s	n
1. Iterative bidding framework--starting point = $25 (Version C)									
D to E (avoid)	16.5	17.0	24	23.7	32.9	54	21.5	29.1	78
D to C	11.7	13.8	24	11.9	15.6	54	11.9	15.0	78
C to B[b]	5.4	9.9	24	5.7	10.7	54	5.6	10.4	78
D to B	17.1	21.5	24	41.4	51.5	54	17.5	23.2	78
Combined: all levels	33.5	33.2	24	17.7	24.1	54	39.0	46.6	78
2. Iterative bidding framework--starting point = $125 (Version D)									
D to E (avoid)	51.6	69.9	22	44.6	84.1	50	46.7	79.6	72
D to C	32.7	48.2	22	29.7	56.0	50	30.6	53.4	72
C to B[b]	9.8	28.2	22	19.9	51.1	50	16.8	45.3	72
D to B	42.5	66.5	22	51.3	102.1	50	48.6	92.3	72
Combined: all levels	94.1	119.8	22	95.9	177.6	50	95.3	161.3	72
3. Direct question framework (Version B)									
D to E (avoid)	23.5	41.6	23	13.5	35.2	51	16.6	37.3	74
D to C	9.9	22.9	23	9.3	22.3	51	9.5	22.4	74
C to B[b]	12.1	28.6	23	7.7	22.5	51	9.1	24.4	74
D to B	23.1	50.5	23	17.7	43.5	51	19.4	45.5	74
Combined: all levels	46.7	84.5	23	31.2	77.0	51	36.0	79.1	74
4. Direct question framework: payment card (Version A)									
D to E (avoid)	36.9	73.9	24	38.9	68.8	51	38.3	70.0	75
D to C	15.8	25.4	24	15.9	30.3	51	15.9	28.7	75
C to B[b]	6.5	21.1	24	5.6	17.3	51	5.9	18.5	75
D to B	24.0	43.6	24	21.7	42.5	51	22.4	42.6	75
Combined: all levels	60.8	115.2	24	60.6	96.1	51	60.7	101.8	75

[a]The two respondents who did not complete the questionnaire are excluded.

[b]D to B includes respondents who were willing to give an amount only for fishable or swimmable water and respondents who were willing to pay some amount to avoid the decrease in water quality in addition to the improvements in water quality.

Table C-7. Estimated Option Values for Changes in Water Quality: Effects of Instrument and Type of Respondent--Protest Bids Excluded

Change in water quality	User $\bar{X}$	User s	User n	Nonuser $\bar{X}$	Nonuser s	Nonuser n	Combined $\bar{X}$	Combined s	Combined n
1. Iterative bidding framework--starting point = $25 (Version C)									
D to E (avoid)	20.8	16.6	19	28.4	34.2	45	26.2	30.1	64
D to C	14.7	14.0	19	14.3	16.1	45	14.5	15.4	64
C to B	6.8	10.7	19	6.9	11.3	45	6.9	11.1	64
D to B[a]	21.6	22.1	19	21.2	25.0	45	21.3	24.0	64
Combined: all levels	42.4	31.9	19	49.7	52.7	45	47.5	47.3	64
2. Iterative bidding framework--starting point = $125 (Version D)									
D to E (avoid)	54.0	70.7	21	54.4	90.2	41	54.3	83.5	62
D to C	34.3	48.8	21	36.2	60.0	41	35.6	56.1	62
C to B	10.2	28.8	21	24.3	55.5	41	19.5	48.4	62
D to B[a]	44.5	67.4	21	62.6	109.8	41	56.5	97.3	62
Combined: all levels	98.6	120.9	21	117.0	190.1	41	110.7	169.0	62
3. Direct question framework (Version B)									
D to E (avoid)	28.5	44.4	19	18.6	40.3	37	21.9	41.6	56
D to C	12.0	24.8	19	12.8	25.4	37	12.6	25.0	56
C to B	14.7	31.0	19	10.6	25.9	37	12.0	27.5	56
D to B[a]	28.0	54.5	19	24.4	49.7	37	25.6	50.9	56
Combined: all levels	56.5	90.2	19	43.0	87.8	37	47.6	88.0	56
4. Direct question framework: payment card (Version A)									
D to E (avoid)	42.1	77.7	21	49.6	74.3	40	47.0	75.0	61
D to C	18.1	26.5	21	20.3	33.0	40	19.5	30.7	61
C to B	7.4	22.5	21	7.1	19.3	40	7.2	20.3	61
D to B[a]	27.4	45.7	21	27.6	46.4	40	27.5	45.8	61
Combined: all levels	69.5	121.0	21	77.3	102.6	40	74.6	108.3	61

[a]D to B includes respondents who were willing to give an amount only for fishable or swimmable water and respondents who were willing to pay some amount to avoid the decrease in water quality in addition to the improvements in water quality.

Table C-8. Option Price-Student t-Statistics for
H O : X = O

With Outliers and Protest Bids Excluded[a]

	User	Nonuser	Total sample
Payment card			
Level D to E	4.56	4.22	5.59
Level D to C	2.62	3.94	4.36
Level c to B		2.34	2.85
Total D to B	2.49	3.82	4.04
Total E to B	4.15	4.81	6.34
Direct question			
Level D to E	2.86	3.05	3.86
Level D to C	2.92	2.93	3.93
Level C to B	2.34	2.26	3.22
Level D to B	3.01	2.86	4,03
Total E to B	3.91	3.03	4.67
Iterative Bidding $25			
Level D to E	7.14	5.20	7.20
Level D to C	5.07	5,97	7.81
Level C to B	3.57	3.86	5.23
Total D to B	5.15	5.63	7.54
Total E to B	6.80	6.05	8.48
Iterative bidding $125			
Level D to E	5.73	4.27	6.42
Level D to C	4.48	3.27	5.16
Level C to B	2.74		3.28
Total D to B	4.54	3.32	5.21
Total E to B	5.70	4.37	6.46

[a]Only those values that are significant at the 0.05 level are reported.

Table C-9. User Value -Student t-Statistics for
$H_o : \bar{X} = 0$
With Outliers and Protest Bids Excluded[a]

	User	Total sample
Payment card		
Level D to E	2.37	2.17
Level D to C		
Level C to B		
Total D to B		
Total E to B	2.29	2.11
Direct question		
Level D to E	2.15	2.01
Level D to C		
Level C to B		
Total D to B		
Total E to B	2.71	2.42
Iterative bidding $25		
Level D to E	2.28	2.12
Level D to C	2.39	2.21
Level C to B	2.73	2.46
Total D to B	3.18	2.76
Total E to D	2.97	2.62
Iterative bidding $125		
Level D to E	2.46	2.23
Level D to C		
Level C to B		
Total D to B	2.22	2.05
Total E to B	2.46	2.23

[a]Only those values that are significant at the 0.05 level are reported.

Table C-10. Option Value Student t-Statistics for Differences in Means Between Bidding Methods-- Outliers and Protest Bids Excluded[a]

	User	Total sample
Iterative bidding $25 vs. iterative bidding $125		
Level D to E	-2.14	-1.97
Total E to B	-2.11	

[a]Only those values that are significant at the 0.05 level are reported.

Table C-11 . Regression Results for Option Price Estimates of Water Quality Changes--Protest Bids Excluded

Independent Variables	D to E (avoid)	D to C	C to B	Total all levels	Total : improvement only
	Water quality change[a]				
Intercept	-22.132 (-0.510)	-18.171 (-0.627)	4.690 (0.177)	-25.618 (-0.308)	-3.486 (-0.069)
Sex (1 male)	23.756 (2.104)	5.268 (0.698)	3.989 (0.577)	33.597 (1.555)	9.840 (0.744)
Age	-0.314 (-0.983)	-0.283 (-1.328)	-0.239 (-1.221)	-0.869 (-1.423)	-0.555 (-1.485)
Education	3.826 (1.244)	1.968 (0.956)	0.306 (-0.162)	5.020 (0.853)	1.194 (0.331)
Income	0.0006 (1.299)	0.0002 (0.587)	0.0002 (0.892)	0.001 (1.178)	0.0004 (0.815)
Direct question	-31.506 (-2.208)	-13.203 (-1 .384)	0.777 (0.089)	-44.026 (-1.613)	-12.520 (-0.749)
Iterative bidding game ($25)	-22.986 (-1.671)	-13.455 (-1.462)	-5.338 (-0.634)	-41.798 (-1.588)	-18.813 (-1.168)
Iterative bidding game ($125)	28.606 (2.028)	21.775 (2.308)	19.461 (2.252)	74.029 (2.743)	45.423 (2.749)
User (1 if user)	12.896 (1.097)	10.799 (1 .374)	10.288 1.430	35.420 1.575	22.523 (1.636)
Willing to pay cost of water pollution (I if very much or somewhat)	18.719 (1.601)	23.848 (3.050)	9.538 1.332	53.944 (2.411)	35.225 (2.572)
Interviewer 1	30.857 (1.325)	13.435 (0.862)	15.658 (1.097)	54.693 (1.227)	23.836 (0.874)
Interviewer 2	7.754 (0.355)	15.931 (1.091)	16.379 (1.224)	34.788 (0.832)	27.034 (1.057)
Interviewer 3	-24.009 (-1.32)	21.959 (1.547)	8.755 (0.674)	1.571 (0.039)	25.580 (1.029)
Interviewer 4	19.348 (0.501)	20.235 (0.783)	32.428 (1.370)	66.575 (0.900)	47.227 (1.043)
Interviewer 5	6.982 (0.316)	3.354 (0.227)	-4.095 (-0.302)	4.168 (0.099)	-2.814 (-0.109)
Interviewer 6	36.351 (0.716)	50 .645 (1.490)	27.450 (0.882)	108.924 (1.121)	72.572 (1.220)
Interviewer 7	42.280 (1.815)	6.505 (0.418)	7.411 (0.520)	58.627 (1.315)	16.347 (0.599
Interviewer 8	11.136 (0.510)	25.584 (1.750)	14.498 (1.083)	46.024 (1.101)	34.888 (1.363
Interviewer 9	49.806 (1.385)	30.573 (1.271)	29.078 (1.320)	101.538 (1.476)	51.732 (1.228
R^2	0.281	0.248	0.148	0.276	0.229
F	3.61	2.99	1.61	3.51	2.74
Degrees of freedom	166	166	166	166	166

[a]Numbers in parentheses are asymptotic t-ratios for the null hypothesis of no association.

Table C-12. Regression Results for User Value Estimates of Water Quality Changes--Protest Bids Excluded

Independent variables	D to E (avoid)	D to C	C to B	Total all levels	Total: improvement only
	Water quality change[a]				
Intercept	26.618 (1.408)	9.513 (0.422)	9.497 (0.546)	24.423 (0.630)	51.041 (1.023)
Sex	-0.567 (-0.115)	-7.465 (-1.273)	-5.447 (-1.204)	-11.303 (-1.122)	-11.870 (-0.915)
Age	-0.328 (-2.512)	‘0.231 (-1.485)	-0.172 (-1.431)	-0.455 (-1 .698)	-0.783 (-2.270)
Education	0.140 (0.104)	0.212 (0.132)	0.253 (0.204)	-0.041 (-0.015)	0.098 (0.028)
Income	0.000002 (0.010)	0.0001 (0.594)	0.0001 (0.452)	0.0003 (0.667)	0.0003 (0.522)
Direct question	-1.694 (-0.271)	-5.944 (-0.796)	-1.312 (-0.228)	-8.307 (-0.647)	-10.001 (-0.605)
Iterative bidding ($2S)	-5.195 (-0.860)	-11.770 (-1.635)	-4.114 (-0.740)	-15.345 (-1.240)	-20.541 (-1.289)
Iterative bidding ($12S)	6.214 (1 .006)	-2.406 (-0.327)	5.525 (0.972)	6.233 (0.492)	12.447 (0.763)
Willing to pay cost	4.790 (0.9s0)	9.560 (1.591)	4.808 (1 .037)	14.834 (1.436)	19.624 (1.475)
Interviewer 1	-10.977 (-1.075)	-3.649 (-0.300)	-7.453 (-0.793)	-9.504 (-0.454)	-20.481 (-0.760)
Interviewer 2	-5.433 (-0.567)	4.711 (0.412)	-1.321 (-0.150)	4.240 (0.216)	-1.193 (-0.047)
Interviewer 3	-9.462 (-1.039)	23.386 (2.153)	8.302 (0.990)	32.793 (1.756)	23.331 (0.970)
Interviewer 4	-11.818 (-0.697)	1.810 (0.090)	-3.542 (-0.227)	-0.471 (-0.014)	-12.289 (-0.275)
Interviewer 5	-12.842 (-1.322)	-5.401 (-0.466)	-9.620 (-1.076)	-12.998 (-0.653)	-25.840 (-1.008)
Interviewer 6	-10.835 (-0.486)	9.970 (0.375)	-1.871 (-0.091)	7.909 (0.173)	-2.926 (-0.050)
Interviewer 7	4.895 (0.482)	6.735 (0.557)	1.162 (0.124)	15.612 (0.750)	20.507 (0.765)
Interviewer 8	-10.016 (-1.044)	6.084 (0.532)	-4.086 (-0.463)	2.539 (0.129)	-7.478 (-0.295)
Interviewer 9	-2.618 (-0.166)	-0.119 (-0.006)	7.050 (0.485)	6.722 (0.208)	4.105 (0.099)
R^2	0.11	0.12	0.09	0.11	0.12
F	1.26	1.32	0.99	1.26	1.39
Degrees of freedom	167	167	167	167	167

[a]Numbers in parentheses are symptotic t-ratios for the null hypothesis of no association.

Table C-13. Regression Results for Option Value Estimates of Water Quality Changes--Protest Bids Excluded

	Water quality change[a]			
Independent variables	D to E (avoid)	D to C	C to B	Total: improvement only
Intercept	-3.931 (-0.105)	1.879 (0.091)	23.017 (1.205)	24.897 (0.684)
Sex	18.033 (1 .745)	7.528 (1.324)	5.259 (1.002)	12.096 (1.209)
Age	-0.341 (-1.172)	-0.302 (-1.885)	-0.232 -1.568)	-0.544 (-1.928)
Education	3.202 (1.143)	1.595 (1.035)	-0.810 -0.569)	0.888 (0.328)
Income	0.0003 (0.830)	-0.0001 (-0.477)	-.0000 (-0.013)	-0.0001 (-0.324)
Direct question	-25.304 (-1.872)	-5.552 (-0.747)	4.980 (0.725)	-0.257 (-0.020)
Iterative bidding ($25)	-15.199 (-1.164)	0.690 (0.096)	0.970 (0.146)	0.775 (0.061)
Iterative bidding ($125)	25.841 (1.936)	27.809 (3.802)	17.004 (2.508)	45.796 (3.544)
Willing to pay cost	27.643 (2.655)	21.039 3.673	10.588 (2.001)	33.146 (3.287)
User	-18.682 (-1.770)	-14.078 (-2.424)	-9.307 (-1.735)	-24.071 (-2.355)
R^2	0.179	0.217	0.090	0.777
F	4.22	5.39	1.92	4.18
Degrees of freedom	175	175	175	175

[a]Numbers in parentheses are asymptotic t-ratios for the null hypothesis of no association.

Table C-14. Regression Results for Option Value Estimates of Water Quality Changes--Protest Bids and Outliers Excluded

Independent variables	Water quality change [a] D to E (avoid)	D to C	C to B	Total: improvement only
Intercept	-35.228 (-1.019)	-24.058 (-1.185)	0.683 (0.043)	-17.021 (-0.547)
Sex	5.779 (8.986)	-0.172 (-0.033)	-2.209 (-0.531)	-4,046 (-0.500)
Age	-0.277 (-1.066)	-0.182 (-1.188)	-0.155 (-1.286)	-0.326 (-1.390)
Education	5.306 (2.131)	2.880 (1.975)	0.148 (0.128)	3.088 (1.378)
Income	0.0006 (1.532)	0.0001 (0.564)	0.0002 (1.39)	0.0003 (0.863)
Direct question	-29.503 (-2.596)	-8.628 (-1.292)	0.786 (0.149)	-6.927 (-0.676)
Iterative bidding ($25)	-14.040 (-1.294)	-0.575 (-0.090)	0.160 (0.032)	-1.138 (-0.116)
Iterative bidding ($125)	13.018 (1.084)	16.697 (2.366)	4.633 (0.833)	23.315 (2.153)
User	14.51.5 (-1.549)	-8.312 (-1.510)	-2.763 (-0.637)	-11.371 (-1.346)
Willing to pay' cost	11.346 (1.224)	14.134 (2.595)	3.666 (0.854)	19.901 (2.382)
Interviewer 1	20.321 (1.100)	6.248 (0.578)	10.166 (1.189)	9.072 (0.545)
Interviewer 2	-1.272 (-0.075)	-0.279 (-0.028)	6.402 (0.818)	-0.745 (-0.049)
Interviewer 3	-9.319 (-0.563)	0.349 (0.036)	2.596 (0.339)	-3.135 (-0.210)
Interviewer 4	-20.891 (-0.656)	-5.726 (-0.306)	16.615 (1.123)	2.848 (0.099)
Interviewer 5	13.911 (0.832)	4.466 (0.454)	2.793 (0.361)	2.562 (0.170)
Interviewer 6	54.899 (1.063)	76.817 (2.530)	55.478 (2.318)	12S .627 (2.698)
Interviewer 7	20.251 (1.070)	1.467 (0.132)	S. 098 (0.582)	2.024 0.119
Interviewer 8	19.014 (1.115)	18.181 (1.814)	15.698 (1.987)	27.557 (1.792)
Interviewer 9	38.062 (0.992)	43.784 (1.942)	-3.945 (-0.222)	30.263 (0.875)
R^2	0.269	0.294	0.129	0.253
F	2.78	3.14	1.12	2.55
Degrees of freedom	136	136	136	136

[a] Numbers in parentheses are asymptotic t-ratios for the null hypothesisof no association.

Table C-15. Regression Results for Option Value Estimates of Water Quality Changes--Protest Bids Excluded

Independent variables	Water quality change[a] D to E (avoid)	D to C	C to B	Total: improvement only
Intercept	-36.611 (-0.890)	-17.778 (-0.770)	2.781 (0.132)	-9.546 (-0.235)
Sex	20.914 (1.953)	9.950 (1.655)	7.304 (1 .329)	15.986 (1.514)
Age	-0.257 (-0.849)	-0.274 (-1.611)	-0.236 (-1.521)	-0.511 (-1.711)
Education	4.067 (1.394)	2.067 (1.262)	-0.321 (-0.214)	1.811 (0.630)
Income	0.0005 (1.252)	-0.0000 (-0.010)	0.0001 (0.610)	0.0001 (0.206)
Direct question	-30.187 (-2.230)	-7.565 (-0.996)	1.854 (0.267)	-4.781 (-0.358)
Iterative bidding ($25)	-16.969 (-1.300)	-1.014 (-0.138)	-0.711 (-0.106)	-2.224 (-0.173)
Iterative bidding ($125)	24.667 (1.843)	26.037 (3.467)	15.358 (2.237)	42.630 (3.231)
User	-14.859 (-1.333)	-11.852 (-1.894)	-7.063 (-1.235)	-19.465 (-1.771)
Willing to pay cost	19.183 (1.730)	18.577 (2.984)	8.014 (1.409)	28.340 (2.592)
Interviewer 1	45.060 (2.039)	19.717 (1.590)	25.128 (2.216)	38.220 (1.754)
Interviewer 2	13.174 (0.636)	11.210 (0.964)	17.693 (1.665)	22.775 (1.115)
Interviewer 3	-4.031 (-0.200)	7.156 (0.633)	7.027 (0.681)	8.697 (0.438)
Interviewer 4	28.659 (0.782)	16.378 (0.796)	34.403 (1.829)	43.904 (1.215)
Interviewer 5	19.815 (0.944)	8.747 (0.743)	5.520 (0.513)	10.171 (0.492)
Interviewer 6	46.018 (0.955)	39.722 (1.469)	28.591 (1.156)	62.895 (1.324)
Interviewer 7	44.117 (1.997)	5.264 (0.425)	10.457 (0.923)	10,920 (0.501)
Interviewer 8	19.804 (0.955)	18.400 (1.581)	17.741 (1.668)	30.310 (1.483)
Interviewer 9	50.923 (1.493)	29.468 1.539	21.089 (1.205)	42.740 (1.271)
R^2	0.241	0.247	0.143	0.212
F	2.93	3.03	1.54	2.48
Degrees of freedom	166	166	166	166

[a]Numbers in parentheses are asymptotic t-ratios for the null hypothesis of no association.

Table C-16. Benefit Estimates from Contingent Ranking Models

Model/estimator	Average	Range
	Payment = 5 Water quality change: boatable to fishable	
Final Model (specification I)		
Ordered logit	-8.77	-73.77 to 115.82
Ordered normal	-9.90	-157.02 to 287.88
II	Payment = 50 Water quality change: boatable to fishable	
Ordered logit	51.40	48.51 to 55.41
Ordered normal	72.45	49.06 to 97.79
III	Payment = 100 Water quality change: boatable to fishable	
Ordered logit	49.56	48.31 to 51.70
Ordered normal	69.39	48.90 to 85.94
IV	Payment = 175 Water quality change: boatable to fishable	
Ordered logit	49.17	48.26 to 50.94
Ordered norms	68.75	48.86 to 83.67
V	Payment = 5 Water quality change: boatable to swimmable	
Ordered logit	-15.78	-132.78 to 208.48
Ordered normal	-17.82	-282.64 to 518.18
VI	Payment = 50 Water quality change: boatable to swimmable	
Ordered logit	92.52	87.31 to 99.74
Ordered normal	130.40	88.30 to 176.02
VII	Payment = 100 Water quality change: boatable to swimmable	
Ordered logit	89.21	86.95 to 93.05
Ordered normal	124.90	88.01 to 154.70
VIII	Payment = 175 Water quality change: boatable to swimmable	
Ordered logit	88.51	86.87 to 91.69
Ordered normal	123.75	87.95 to 150.60

Table C-17. Estimated Option Values fcr Water Quality Change: Effects of Instrument and Type of Respondent--Protest Bids and Outliers Excluded

Change in water quality	User[a] $\bar{X}$	User[a] s	User[a] n	Nonuser $\bar{X}$	Nonuser s	Nonuser n
1. Iterative Bidding Framework, Starting Point = $25						
D to E (avoid)	21.43	16.81	14	28.52	34.16	44
D to C	14.64	12.32	14	14.55	15.47	44
C to B	8.93	11.80	14	6.48	11.13	44
D to B[b]	23.57	22.65	14	21.02	23.61	44
2. Iterative Bidding Framework, Startinq Point = $125						
D to E (avoid)	62.33	67.03	15	37.58	50.96	33
D to C	40.33	49.77	15	25.45	44.90	33
C to B	14.00	33.60	15	11.21	32.60	33
D to B[b]	54.33	72.60	15	39.24	68.30	33
3. Direct Question Framework						
D to E (avoid)	18.21	31.29	14	17.89	34.42	37
D to C	10.50	26.94	14	10.62	20.74	37
C to B	9.86	27.14	14	8.73	20.97	37
D to B[b]	22.14	53.73	14	20.30	39.75	37
4. Payment Card						
D to E (avoid)	27.73	30.03	11	49.19	72.69	43
D to C	15.91	21.19	11	20.47	32.27	43
C to B	5.00	10.00	11	6.63	18.70	43
D to B[b]	20.91	27.46	11	28.26	44.87	43

[a]These results are based on the narrow definition of users.

[b]D to B represents the sum of bids for the improvements in water quality and for some individuals the payment to move from Level D to Level B directly.

Table C-18. A Comparison of Contingent Valuation and Travel Cost Benefit Estimates--Protest Bids and Outliers Excluded[a]

	AWQ = Loss of area		AWQ = Beatable to fishable		AWQ Boatable to swimmable	
	Model	Test[b]	Model	Test[b]	Model	Test[b]
Independent variable						
Intercept	17.482 (1.022)	-	35.422 (1.672)		58.359 (1.669)	
Travel cost benefit estimate	.450 (1.475)	3.608	-4.923 (-1.298)	-1.708	-3.166 (-1.076)	-1.600
Qualitative variables						
Payment card	-34.502 (-2.335)	-	69.510 (2.883)		109.632 (2.734)	
Direct question	-27.039 (-2.062)	-	17.831 (0.850)		17.421 (0.499)	
Iterative bid ($25)	-28.803 (-1.993)	-	-4.740 (-0.201)		-11.500 (-0.283)	-
R^2	.117		.158		.146	
n	68		68		68	
F	2.09 (0.09)[c]		2.96 (0.03)[c]		2.68 (0.04)[c]	

[a]The numbers in parentheses below the estimated coefficients are t-ratios for the null hypothesis of no association.

[b]This column reports the t-ratio for the hypothesis that the coefficient for the travel cost variable was 1.55. The travel cost model measures consumer surplus in 1977 dollars. The contingent valuation experiments were conducted in 1981. Using the consumer price index to adjust the travel cost benefit estimates to 1981 dollars would require multiplying each estimate by 1.55. Since the estimated regression coefficients (and standard errors) will correspondingly adjust to reflect this scale change, a test of the null hypothesis that the coefficient of travel cost was equal to unity is equivalent to a test that Is equal to 1.55 when the travel cost benefit estimates are measured in 1977 dollars and user values estimates (the dependent variable) are in 1981 dollars.

[c]This number in parentheses below the reported F-statistic is the level of significance for rejection of the null hypothesis of no association between the dependent and independent variables.

APPENDIX D

SURVEY QUESTIONNAIRES

This appendix contains two parts. Part 1 contains the survev question-naires as administered during the survey of the Monongahela River basin. Part 2 contains a brief summary of suggestions for improving the questionnaire for future use in similar surveys.

PART 1

SURVEY QUESTIONNAIRE AS ADMINISTERED DURING THE MONONGAHELA RIVER BASIN SURVEY

OMB # 2000-0381
Approval Expires: 9/20/82

ESTIMATING BENEFITS OF WATER QUALITY QUESTIONNAIRE

Form ??0. 02
(1)

I. IDENTIFICATION INFORMATION

A. Study No. ☐☐☐☐ *(2-6)*

B. PSU/Segment No. ☐ - ☐☐☐☐☐ *(8-13)*

C. Housing Unit No. ☐☐☐

D. Interviewer ID No. ☐☐☐☐☐☐ *(Skip)*

E. Sample Individual Roster Line No. m (19-20)

F. Questionnaire Version **A** (22)

II. INTRODUCTION

IF THE ENUMERATION RESPONDENT IS ALSO THE SELECTED SAMPLE INDIVIDUAL, CONTINUE YOUR INTRODUCTION TO THE STUDY BY READING THE SECOND PARAGRAPH BELOW. IF TNE SAMPLE INDIVIDUAL IS SOMEONE OTHER THAN THE ENUMERATION RESPONDENT, READ THE ENTIRE INTRODUCTION BELOW.

Hello, I'm (NAME) from the Research Triangle Institute in North Caroline. We are doing a study for a government agency to study levels of water quality and some outdoor recreational activities people take psrt in both near and on ponds, lakes, streams and rivers in the Monongahela River Basin. You have been randomly selected to participate in the study.

Your participation is entirely voluntary and you may refuse to answer any questions. Because only a small number of people are being selected for the study, the participation of each person selected is extremely important. Most of the questions have to do with your attitudes and opiniona and there are no right or wrong answers. The information which you provide will be kept strictly confidential and will be used only for overall statistical results. If you would like, we will send you a summary of the results of the study.

CHECK APPROPRIATE BOX BELOW AND IF "YES*' PRINT RESPONDENT'S MAILING ADDRESS.

RESULTS REQUESTED : YES ☐ NO ☐

Mailing Address

______________________________ Number/Street/RFD ______ Apt . No.

______________________________ City/State ☐☐☐☐☐ ZIP

INTERVIEW START TIME : ______________ AM/ PM

A-3 LEAVE CARD 1 IN FRONT OF RESPONDENT. GIVE RESPONDENT CARD 2, "LIST OF SITES." Here is a list of recreational sites in the area. GIVE RESPONDENT CARD 3, "PICTORIAL MAP." And here is a pictorial map showing the location of these sites. ALLOW RESPONDENT TIME TO LOOK AT BOTH CARDS. THESE THREE CARDS SHOULD REMAIN IN FRONT OF THE RESPONDENT THROUGHOUT THE INTERVIEW.

How many times within the past twelve months did you visit any of the sites listed on this card or any other recreational site near water?

AS SITES ARE MENTIONED, RECORD SITS CODE AND NUMBER OF TIMES THE SITE WAS VISITED. THEN ASK: Which activities listed on Card 1 did you participate in at that site during the last 12 months?

CIRCLE THE ACTIVITY NUMBER(S) IN THE COLUMN ACROSS FROM THE SITE(S) MENTIONED.

IF UNLISTED SITES ARE MENTIONED, ENTER SITE NAME ON LINE AND RECORD NUMBER(S) OF VISITS ANO ACTIVITIES.

Site Name Not Listed	Site Codes	No. of Visits	CANOEING, KAYAKING, ETC.	OTHER BOATING	SAILING	WATER SKIING	FISHING	SWIMMING, SUNBATHING	CAMPING	PICNICKING	BIRD/WILDLIFE OBSERV/PHOTO	OTHER WALKING/JOGGING	BICYCLING	HORSEBACK RIDING	HUNTING	HIKING OR BACKPACKING	ATTEND SPORTS EVENTS	OTHER OUTDOOR SPORTS	OFF ROAD DRIVING/RIDING	PLEASURE DRIVING	SIGHTSEEING
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	06	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	06	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	1s	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	-09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	0s	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
			01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19

A. RECREATIONAL ACTIVITIES

A-1 a. First, do you own or have the use of any kind of boat? CIRCLE NUMBER.

YES . . . . 01 (GO TO A-l b.) 23)

NO . . . . 02 (GO TO A-2)

b. Which of the following describes the boat you use meet often? READ ANSWER CHOICES ANO CIRCLE NUMBER.

SAILBOAT 01 24)

INBOARD 02

OUTBOARD 03

CANOE 04

OTHER (SPECIFY) 05

____

A-2 The next few questions we would like to ask deal with outdoor recreational activities which people take part in near lakes and rivers in this area; that is, the activities shown on this card. GIVE RESPONDENT CARD 1, "ACTIVITY CARD". Please look carefully over the list of activities, keeping in mind that all the activities listed refer to activities near lakes or rivers. ALLOW RESPONDENT TIME TO LOOK AT TEE LIST.

Within the past 12 months, that is since last November, did you take part in any of the activities listed? CIRCLE NUMBER.

Yes. . . . . 01 (GO TO A-3) (25)

No . . . . 02 (GOTO B-1)

B. BENEFITS MEASURES

B-1 The next group of questions is about the quality of water in the Monongahela River. Congress passed water pollution control laws in 1972 and in 1977 to improve the nation' s water quality. The states of Pennsylvania and West Virginia have also been involved in water quality improvement programs of their own. These programs have resulted in cleaner rivers that are better places for fishing, boating, and other outdoor activities which people take part in near water. We all pay for these water quality improvement programs both as taxpayers and as consumers.

In this study we sre concerned with the water quality of only the Monongahela River. Keep in mind that people take part in all of the activities on Card 1 both on and near the water.

Generally, the better the water quality, the better suited the water is for recreational activities snd the more likely people" will take part in outdoor recreational activities on or near the water. Here is a picture of a ladder that showa various levels of water quality. GIVE RESPONDENT CARD 4, "WAKER QUALITY LADDER".

The top of the ladder stands for the best possible quality of water, The bottom of the ladder stands for the worst possible water quality. On the ladder you can see the different levels of the quality of the water. For example: (POINT TO SEX LEVEL -- E, D, C, B, A -- AS YOU READ THE STATEMENTS BELOW.)

Level "E" (POINTING) iS so polluted that it has oil, raw sewage and other things like trash in it; it haa no plant or animal life and smells bad.

Water at level "D" is okay for boating but not fishing or swimming.

Level "C" shows where the water is clean enough ao that game fish like baas can live in it.

Level "B" shows where the water ia clean enough so that people can swim in it safely.

And at level "A", the quality of the water ia so good that it would be possible to drink directly from it if you wanted to.

card 5

1-22 Dup.

a. Now, think about the water quality of the Monongahela River on the whole. In terms of this scale, from zero to ten, how would you rate the water quality of the Monogahela River at the present time? POINT TO THE ZERO-TO-TEN SCALE ON THE LADDER AND CIRCLE NUMBER.

00 01 02 03 04 05 06 07 08 09 10 (GO TO B-1. h.) (23-24)

EON' T KNOW . . . . 11 (GO TO B-2)

b. Is your rating for a particular site on the river? CIRCLE NUMBER.

Yes . . . . .01 (GO TO B-I.e.) (2S)

NO . . . . .02 (Go TO B-2)

c. On the map, please show me which river site your rating applies to. (26-27)

Site Code: m

IF NOT ON LIST OF RECREATIONAL SITES, SPECIFY:

____

B-2 Another important purpose of this study is to learn how much the quality of water of the Monongahela River ia worth to the people who live in the river basin. In answering this question, there are three waya of thinking about water quality that might influence your decision. GIVE RESPONDENT CARD 5, "VALUE CARD". The three ways are shown on this card.

a. One, you might think about how much water quality is worth to you because you use the river for recreation. POINT TO PART I OF VALUE CARD AND GIVE RESPONDENT TIME TO READ THAT PART.

How important a factor is your actual use of the river in making a decision about how much clean water ia worth to you? CIRCLE NUMBER. (28-29)

VERY IMPORTANT 01

SOMEWHAT IMPORTANT 02

NEITHER IMPORTANT NOR UNIMPORTANT 03

NOT VERY IMPORTANT 04

NOT IMPORTANT AT ALL . . . 05

b. Another way you might think about how much clean water ia worth to you is that it is worth something to you to know that a clean water river is being maintained for your uae if you should decide, in the future, that you want to use it. POINT TO PART II OF VALUE CARD AND GIVE RESPONDENT TIME TO READ THAT PART. For example, You might buy an advance ticket for the Steelers or Pirates just to be able to go to a home game if you later decide you want to go. Likewise, you might pay some amount each year to have a clean water river available to use if you should decide to use it.

In deciding how much clean water is worth to you, how important a factor ia knowing that a clean water river is being maintained for your uae, if you should decide to uae it? CIRCLE NUMBER. 30-31)

VERY IMPORTANT 01

SOMEWHAT IMPORTANT 02

NEITHER IMPORTANT NOR UNIMPORTANT 03

NOT VERY IMPORTANT 04

NOT IMPORTANT AT ALL . . 05

C. A third thing you might think about in deciding how much clean water is worth to you is the satisfaction of knowing that a clean water river is there. POINT TO PART III OF VALUE CARD AND GIVE RESPONDENT TIME TO READ THAT PART. For example, you might be willing to pay something to maintain a public park even though you know you won't use it. The same thing could be true for clean water in the Monongahela; that is, you might pay something just for the satisfaction of knowing that it is clean and that others can use it.

In deciding how much clean water is worth to you, how important is knowing that a clean water river is being maintained? CIRCLE NUMBER.

VERY IMPORTANT 01 (32-33)

SOMEWHAT IMPORTANT 02

NEITHER IMPORTANT NOR UNIMPORTANT 03

NOT VERY IMPORTANT 04

NOT IMPORTANT AT ALL . . . 05

INTRODUCTION TO QUESTION B-3

Now, we would like for you to think about the relationship between improving the quality of water in the Monongahela River and what we all have to pay each year as taxpayers and as consumers. We all pay directly through our tax dollars each year for cleaning up all rivers. We also pay indirectly Each year through higher prices for the products we buy because it costs companies money to clean up water they use in making their products. Thus, each year, we are paying directly and indirectly for improvements in the water quality of the Monongahela River.

I want to ask you a few questions about what amount of money you would be willing to pay each year for different levels of water quality in the Monongahela River. Please keep in mind that- the amounts you would pay each year would be paid in the formof taxes or in the form of higher prices for the products that companies sell.

We are talking about different levels of water quality for only the Monongahela River, with water quality at other sites on Card 2 staying the same as it is now.

I also want you to keep in mind the recreational activities that you now do and that you might do in the future on the Monongahela River or at other sites. That is, keep in mind the first two parts of the value card. (POINT TO TBE VALUE CARD. CARD 5.) Your actual use or possible use can involve activities in the water or near the water,or both, as we talked about earlier.

We know that for the monongahela River as a whole the current water quality is at level "D", but that it may vary at different points along the river. At level "D"it is clean enough for boating, but not clean enough for catching game fish or for swimming.

NAVE REMINDER CARD READY. RECORD DOLLAR AMOUNTS GIVEN FOR EACH PART ASKED.

B-3 a. This payment card shows different yearly amounts people might be willing to pay for different levels of water quality. HAND RESPONDENT CARD 6, "PAYMENT CARD , " AND ALLOW RESPONDENT TIME TO LOOK AT IT.

What is the most it is worth to you (and your family) on a yearly basis to keep the water quality in the Monongahela River from slipping back from level "Q" to level "E", where it is not even clean enough for boating? Please pick any amount on the card, any amount in-between, or any other amount you think is appropriate.

$ ____________ DOLLARS (IF ANY AMOUNT, GO TO B-3. b.; IF ZERO DOLLARS, ASK .)

Would it be worth something to you (and your family) to raise the water quality level from level "D" to a higher level? CIRCLE NUMBER.

YES . . . . 01 (CO TO B-3. b.)

NO . . . . .02 (GO TO B-3. e.)'

b. (In addition to the amount You just told me,) What ia the most that you would be willing to pay each year in higher taxes and prices for products that companies sell to raise the water quality from level "D" to level "C",where game fish can live in it and it is improved for other activities?

$ ____________ DOLLARS (IF ANY AMOUNT, GO TO B-3. c.; IF ZERO DOLLARS, GO TO B-3. d.) *(37-39)*

c. How much more then (READ AMOUNT FROM b.)would you be willing to pay each year in higher taxes and prices for products that companies sell to raise the water quality from level "C" to level "B", where it is clean l nough for swimming and it is improved for other activities?

$ ____________ DOLLARS (GO TO B-4) *(40-41)*

d. What is the most that you would be willing to pay each year in higher taxes and prices for products that companies sell to raise the water quality from level "D" to level "B", where it is clean enough for swimming and it is improved for other activities?

$ ____________ DOLLARS (IF ANY Amounting., GO TO B-4; IF ZERO DOLLARS IN a. AND:
- ANT AMOUNT IN d., GO TO B-4. d.;
- ZERO DOLLARS IN d., GO TO B-3. e.)

(43-45)

e. We have found in studies of this type that people have a lot of different reasons for answering as they do. Some people felt they did not have enough information to give a dollar amount, some did not want to put dollar values on environmental quality, and some objected to the way the question was presented. Others gave a zero dollar amount because that was what it was worth to them.

Which of these reasons best describes why you answered the way you did? REPEAT REASONS IF NECESSARY AND CIRCLE NUMBER.

(45-47)

NOT ENOUGH INFORMATION . . 01

DID NOT WANT TO PLACE
DOLLAR VALUE 02

OBJECTED TO WAY QUESTION
WAS PRESENTED 03

THAT IS WHAT IT IS WORTH . 04

OTHER (SPECIFY) 05

(GO TO B-6)

____

B-4 REFER TO REMINDER CARD. DO NOT ASK QUESTIONS CORRESPONDING TO ZERO AMOUNTS ON CARD.

a. IIS answering the next question(s), keep in mind your actual and possible future use of the Monongahela. You told me in the last section that it was worth $(AMOUNT) to keep the water quality from slipping from level "D" to level "E". How much of this amount was based on your actual use of the river?

$ ______________________ (48-50)

b. You (also) told me that you would be willing to pay $(AMOUNT) co raise the water quality from level "D" to level "C". POINT TO LEVELS "n" AND "c". How much of this amount was due to your actual use of the river?

$ ______________________ (51-53)

c. You (also) told me that you would be willing to pay $(AMOUNT) to raise the water quality from level "C" to level "B". POINT TO LEVELS "C" AND "B". How much of this amount was due to your actual use of the *river?*

$ ______________________ (GO TO B-5) (54-56)

d. You told me in the last question that you would be willing to pay $(AMOUNT) to raise the water quality from level "D" to level "B". POINT TO LEVELS "D" AND "B". How much of this amount was due *to your* actual *use* of the river.

$ ______________________ (57-59)

B-5 REFER TO REMINDER CARD. You have said that you would be willing to pay $ (AMOUNT) to keep the level of water quality from slipping from level "D" to level "E" and you said that you would be willing to pay $(b. PLUS c.) OR d.) to raise the level from level "D". This is a total of (READ TOTAL $ AMOUNT).

Let' s think about another way that the quality of water in the Monongahela River could affect your recreation on or aear water. I would like you to think about how the river being closed for certain activities for different periods of time would change the (READ TOTAL $ AMOUNT) you would be willing to pay per year. Suppose the government is considering relaxing the water pollution control laws, but aot totally removing them. This would mean that the overall quality of the water in the Monongahela River would decrease to level "E" where it would be closed some weekends for activities on or in the water like boating, fishing and swimming and you would not know it was closed until the day you wanted co go. '*The area,* however, would remain open all weekends for activities near the water, like jogging *or* hiking or picnicking.

a. If the water pollution laws were relaxed to the point that the water quality would decrease to level "E" and the area would be closed 1/4 of the weekends of the year for activities on or in the water but would remain open for activities near the water, how much would you change this (READ TOTAL $ AMOUNT) to keep the area open all weekends for all activities?

$________________ DOLLAR CHANGE (60-62)

b. If the area would be closed for activities on or in the water 1/2 of the weekenda, how much would you change this (READ TOTAL $ *AMOUNT*) to keep the area open all weekenda for all activities?

$________________ DOLLAR CHANGE (63-65)

c. If the area would be closed for activities on or in the water 3/4 of the weekends, how much would you change this (READ TOTAL $ *AMOUNT*) to keep the area open all weekends for all activities?

$________________ DOLLAR CHANGE (66-68)

B-6 a. If the water quality in the Monongahela River were improved from Level "D" to level "B", where it is clean enough for swimming and it is improved for other activities, how would this affect your annual use or future use of sites along the river? CIRCLE NUMBER.

(69-70)

INCREASE USE BY HORS THAN 5 VISITS PER YEAR . . . 01
INCREASE USE BY 1 TO 5 VISITS PER YEAR. 02
NO CHANGE LO USE 03
DECREASE USE ALONG THE MONONGAHELA RIVER. 04
DON'T SNOW 05

b. How would this change from "D" to "B" in the Monongahela River affect your annual use or future uae of other recreational sites near water, but not along the Monongahela River? CIRCLE NUMBER.

(71-72)

DECREASE USE BY MORE TBAN 5 VISITS PER YEAR . . . 01
DECREASE USE BY 1 TO 5 VISITS PER TEAR. 02
NO CHANGE IN USE 03
INCREASE SE.. . . . . , ...04
CON' T KNO 05

B-7 Up to now we have talked about water quality baaed on your use and possible future use of the Monongahela River. Let' s again think about the third part of the value card. That is, it is worth something just to know a river with clean water is there without actually using it or planning to use it. We want you to think only in terms of this satisfaction which excludes any use by you of the river. With this in mind, suppose the government were to remove the water pollution laws entirely. This would mean lower taxes and would allow companies to produce their products at lower prices. But, it would also mean that during most of the rest of your lifetime the Monongahela River would be at level "E" and would not be usable for recreational activities. The change could be reversed in your lifetime but it would cost a great deal of money.

a. What is the most that you (and your family) would be willing to pay each year in the form of higher taxes and prices for the goods you buy for keeping the river at level "D" where it is okay for boating, ●ven if you would never use the river?

$ ______________ (IF ANY AMOUNT, GO TO B-7. b.; IF ZERO DOLLARS, GO TO B-8) (73-75)

b. Suppose the change could not be reversed for *an even longer* period of time than your lifetime. How much more than (READ AMOUNT FROH *a.)* would you (and your family) be willing to pay per year to keep the river at level "D", even if you would never use the river?

$ ______________ (76-78)

Col. 80 = 5

B-8 GIVE RESPONDENT THE FOUR CARDS FROM THE CARD SET 7. I would now like you to look at these cards which show different combinations of levels of water quality and amounts in higher taxes and prices it would coet every family each year to have the indicated water quality levels.

a. First, I would like you to rank the combinations of water quality levels and amounts you might be willing to pay to obtain those levels in order from the card, or combination, that you most prefer to the one you least prefer. I would like you to do this based only on your use And possible use in the future of the Monongahela River. That is, keeping in mind only Parts I and II of the value card. POINT TO VALUE CARD - PARTS I AND II. RECORD RANKING OF CAMS BY CIRCLED WATER QUALITY LEVELS AND DOLLAR AMOUNTS.

Card 6

1-22

Dup.

RANRING	WATER QUALITY LEVEL	$ AMOUNT	
Host Preferred		$	(24-27)
2nd		$	(28-31)
3rd		$	(32-35)
Least Preferred		$	(36-39)

b. Now, I would like you to repeat this procedure but assume this time that you will not use the river now or in the future. That is, think about only Part III of the value card. POINT TO VALUE CARD - PART III. RECORD RANKING OF CARDS BY CIRCLED WATER QUALITY LEVELS AND DOLLAR AMOUNTS.

RANKING	WATER QUALITY LEVEL	$ AMOUNT	
Most Preferred		$	(40-43)
2nd		$	(44-47)
3rd		$	(48-51)
Least Preferred		$	(52-55)

Col. 80 = 6

C. BACKGROUND DATA

I have a few more questiona that will help our research staff analyze the results of the study properly.

Card 7

:-22

Dup.

C-1 How long have you lived in the Monongahela River basin area? CIRCLE NUMBER. (24-25)

LESS THAN 1 YEAR 01

1 YEAR OR LONGER BUT LESS THAN 3 YEARS 02

3 YEARS OR LONGER BUT LESS THAN 5 YEARS 03

5 YEARS OR LONGSR 04

C-2 Now I am going to read some phrases that describe, different kinds of interesta people have. Aa I read each one, please tell me how ❑uth the phrase is like you; that is, a lot like you, somewhat like you, a little like you, or not at all like you. CIRCLE ONE NUMBER ON EACH LINE. REPEAT ANSWER CHOICES AS NECESSARY.

	A LOT	SOHE WHAT	A LITTLE	NOT AT ALL	NO OPINION	
a. AN OUTDOORS PERSON	01	02	03	04	05	(26-27)
b. AN ENVIRONMENTALIST	01	02	03	04	05	(28-29)
c. SOMEONE WHO IS AGAINST NUCLEAR POWER FOR ELECTRIC PLANTS	01	02	03	06	05	(30-31)
d. SOMEONE WHO IS CONCERNED ABOUT WATER POLLUTION	01	02	03	04	05	(32-33)
e. SOMEONE WHO IS WILLING TO PAY THE COST REQUIRED TO CONTROL WATER POLLUTION	01	02	03	04	05	(34-35)

C-3 Which of the following best describes your present status? READ CHOICES AS NECESSARY AND CIRCLE NUMBER. (36-37)

EMPLOYED FULL-TIME. 01
EMPLOYED PART-TIME. . . 02
RETIRED 03
(GO TO C-5)

NOT EMPLOYED 04
A HOUSEWIFE 05
A STUDENT 06
(GO TO C-4)

OTHER (SPECIFY) 07

____

C-4 Have you ever been employed? CIRCLE NUMBER.

YES- . . . . .01 (GO TO C-5) (38-39)

NO. . . . . 02 (GO TO C-6)

C-5 a. What kind of *work* (do/did) you do; that is, what (*s/was) your job* called?

_______________________________ (40-42)

____

____

b. What (do/did) you actually do in that job? What (are/were) some of your main duties and responsibilities?

_______________________________ (43-45)

____

____

c. What kind of an organization (do/did) you work for? (PROBE : What do they make, what do they do?) BE SURE TO NOTE IF RESPONDENT IS AN EMPLOYEE OF GOVERNMENT AT ANY LEVEL , INCLUDING THE SCHOOL SYSTEM.

_______________________________ (46-48)

____

____

d. How many hours (do/did) you work at your job in a usual week?

______________ NUMBER OF HOURS WORKED IN A WEEK (49-50)

C-6 What was the last grade of regular school that you completed -- not counting specialized schools like secretarial, art, or trade schools? CIRCLE NUMBER.

NO SCHOOL 01 (51-52)

GRADE SCHOOL (l-8). . . . 02

SOME HIGH SCHOOL (9-1) . . 03

HIGH SCHOOL GRADUATE 12) . 04

SOME COLLEGE (13-15). . . . 05

COLLEGE GRADUATE (16) . . . 06

POST GRADUATE (17+) . . . 07

NO RESPONSE/REFUSED . . . 08

C-7 ASK ONLY IF NOT OBVIOUS. How would you describe your racial or ethnic background? READ CHOICES AND CIRCLE NUMBER.

(53-54)

WHITE OR CAUCASIAN. 01
BLACK OR NEGRO. 02
oTHER (SPECFIY) 03

____

C-8 Here is a list of income categories. HAND RESPONDENT CARD 8. Would you call off the code number of the category that best describes the combined income that you (and all other members of your family) received during 1980. Please be sure to include wages and salaries, or net income from your business, and pensions, dividends, interest, and Any other income. CIRCLE NUMBER.

(55-56)

UNDER $5,000 01
$5,000 - $9,999 02
$10,000 - $14,999 03
$15,000 - $19,999 04
$20,000 - $26,999 05
$25,000 - $29,999 06
$30,000 - $36,999 07
$35,000 - $39,999 08
$60,000 - $44,999 09
$45,000 - $49,999 10
$50,000 AND OVER. 11
NOT SURE/REFUSED. 12

Col. 80 = 7

C-9 There is a possibility that my supervisor would like to call you to verify your participation in this study. What is the telephone number where you can be reached?

TELEPHONE NUMBER: (________) ________ - ____________

Thank you for participating in this study.

INTERVIEW STOP TIME: ________________ AM / PM

OHS # 2000-0381
Approval Expires: 9/20/82

ESTIMATING BENEFITS OF WATER QUALITY QUESTIONNAIRE

Form No. 02
(i)

I. IDENTIFICATION INFORMATION

A. Study NO. ☐☐☐☐☐ - ☐ *(2-6)*

B. PSU/Segment No. ☐ - ☐☐☐☐☐ *(8-13)*

C. Housing Unit No. ☐☐☐ *(15-17)*

D. Interviewer ID No. ☐☐☐☐☐☐ *(Skip)*

E. Sample Individual Roster Line No. m *(19-20)*

F. Questionnaire Version B (22)

II. INTRODUCTION

IF TEE ENUMERATION RESPONDENT IS ALSO THE SELECTED SAMPLE INDIVIDUAL, CONTINUE YOUR INTRODUCTION TO THE STUDY BY READING THE SECOND PARAGRAPH BELOW. IF THE SAMPLE INDIVIDUAL IS SOMEONE OTHER THAN THE ENUMERATION RESPONDENT, READ THE ENTIRE INTRODUCTION BELOW .

Hello, I' m (NAME) from the Research Triangle Institute in North Carolina. We are doing a study for a government agency to study levels of water quality and some outdoor recreational activities people take part in both near and on ponda, lakes, streams and rivers in the Monongahela River Baain. You have been randomly selected to participate in the study.

Your participation is entirely voluntary and you may refuse to answer any questions. Because only a small number of people are being selected for the study, the participation of each person selected is extremely important. Most of the questions have to do with your attitudes and opinions and there are no right *or* wrong answers. The information which you provide will be kept strictly confidential and will be used only for overall statistical results. If you would like, we will send you a summary of the results of the study.

CHECK APPROPRIATE BOX BELOW AND IF "YES" PRINT RESPONDENT'S MAILING ADDRESS .

RESULTS REQUESTED: YES ☐ NO ☐

Hailing Address

____
Number/Street/RFD Apt. No.

____ ☐☐☐☐☐
City/State ZIP

INTERVIEW START TIME: ______________ AM / PM

B-3 a. What is the ❑ost it is worth to you (and your family) on a yearly basis to keep the water quality in the Monongahela River from slipping back from' level "D" to level "E", where it is not even clean enough for boating?

$ ______________ DOLLARS (IF ANY AMOUNT, GO TO B-3. b.; IF 2ER0 DOLLARS , ASK .) (34-36)

> Would it be worth something to you (and your family) to raise the water quality level from level "D" to a higher level? CIRCLE NUMBER.
>
> Es . . . . 01 (GO TO B-3. b.)
>
> No . . . . 02 (GO TO B-3. e.)

b. (In addition to the amount You just told me,) What is the most tha you would be willing to pay each year in higher taxes and prices fo products that companies sell to raise the water quality from leve "D" to level "C",- where game fish can live in it and it is improve for other activities?

$ ______________ DOLLARS (IF ANY AMOUNT, GO TO B-3. c.; IF ZERO DOLLARS, GO TO B-3. d.) (3?-39)

c. How much more than (READ AMOUNT FROM b.) would you be willing to pa each year in higher taxes and prices for products that companie sell to raise the water quality from level "C" to level "B", wher it is clean enough for swimming and it is improved for other activi ties?

S ______________ *DOLLARS (CO* TO B-4) (40-42)

d. ***What*** **is the most that you would be willing to pay each year in higher taxes and prices for products that companies sell to raise the water quality from level "D" to level "B", where it is clean enough for swimming and it is improved for other activities?**

$ ____________ DOLLARS (IF ANY AMOUNT IN a., GO TO B-4; IF ZERO DOLLARS IN a. AND: . ANY AMOUNT IN **d., 00 TO B-4. d.;** . **ZERO DOLLARS IN d., CO TO B-3. e.**) **(43-45)**

e. **We have found in studies of this type that people have a lot of different reasons for answering as they do. Some people felt they did not have enough information to give a dollar amount, some did not want to put dollar** values on **environmental quality, and some objected to the way the question** was **presented. Others gave a zero dollar amount because that was what it was worth to them.**

Which *of* these reasons best describes why you answered the way you did? REPEAT REASONS IF NECSSSARY AND CIRCLE NUMBER. **(46-47)**

NOT ENOUGH INFORMATION . . 01-
DID NOT WANT TO PLACE DOLLAR VALUE 02
OBJECTED TO WAY QUESTION WAS PRESENTED 03
THAT IS WHAT IT IS WORTH . 04
OTHER (SPECIFY) 05

(00 **TO** B-6)

____

OMB # 2000-0381
Approval Expires: 9/20/82

ESTIMATING BENEFITS OF WATER QUALITY
QUESTIONNAIRE

Form No. 02
(1)

I. IDENTIFICATION INFORMATION

A. Study No. [ ][ ][ ][ ] - [ ] *(2-6)*

B. PSU/Segment No. [ ] - [ ][ ][ ][ ][ ] *(8-13)*

C. Housing Unit No. [ ][ ][ ] *(15-1?)*

D. Interviewer ID No. [ ][ ][ ][ ][ ][ ] *(Skip)*

E. Sample Individual Roster Line No. m (19-20)

F. *Questionnaire* Version c (22)

II. INTRODUCTION

IF THE ENUMERATION RESPONDENT IS ALSO THE SELECTED SAMPLE INDIVIDUAL, CONTINUE YOUR INTRODUCTION TO THE STUDY BY READING THE SECOND PARAGRAPH BELOW. IF THE SAMPLE INDIVIDUAL IS SOMEONE OTHER THAN THE ENUMERATION RESPONDENT, READ THE ENTIRE INTRODUCTION BELOW.

Hello, I'm (NAME) from the Research Triangle Institute in North Carolina. We are doing a study for a government agency to study levels of water quality and some outdoor recreational acclivities people take part in both near and on ponds, lakes, streams and rivers in the Monongahela River Basin. You have been randomly selected to participate in the study.

Your participation is entirely voluntary and you may refuse to answer any questions. Because only a small number of people are being selected for the study, the participation of each person selected is extremely important. Most of the questions have to do with your attitudes and opinions and there are no right or wrong answers. The information which you provide till be kept strictly confidential and will be used only for overall statistical results. If you would like, we will send you a summary of the results of the study.

CHECK APPROPRIATE BOX BELOW ANO IF "YES" PRINT RESPONDENT'S MAILING ADDRESS.

RESULTS REQUESTED: YES [ ] NO [ ]

Mailing Address
_______________________________ Number/Street/RED _______ Apt. No.
_______________________________ City/State _______ ZIP

INTERVIEW START TIME: __________ AM/Pm

B-3 a. To you (and **your family), would it be worth $25 each year in higher taxes and prices for products that companies sell to keep the water quality in the Monongahela River from slipping back from level "D" to level "E"? CIRCLE NUMBER.**

YES 01

NO 02

IF YES, INCREASE THE DOLIAR MOUNT IN $5 INCREMENTS UNTIL A "NO" ANSWER IS GIVEN. E. G., **"Would it be worth $30 each year to keep water quality from slipping from level 'D'** to 'level **'E'?" ETC. WNEN** A "NO" ANSWER IS GIVEN, RECORD DOLLAR AMOUNT OF LAST "YES" ANSWER.

IF NO, DECREASE THE DOLLAR AMOUNT IN $5 INCREMENTS **UNTIL** A "YES" ANSWER IS **GIVEN. E. G., "Would it be worth $20 each year to keep water quality from slipping** from level 'D' to level 'E'?" ETC. WHEN A "YES" ANSWER IS GIVEN. RECORO DOLLAR AMOUNT.

$ ____________ **DOLLARS** (**IF ANY AMOUNT, GO TO B-3. b.; IF** ZERO **DOLLARS IS** FINAL MOUNT, **ASK**)

(34-36)

Would it be worth something to you (and your family) to raise the *water* **quality level from level "D" to a higher level?** CIRCLE **NUMBER.**

YES . . . . **01 (GO TO B-3. b.)**

NO . . . . **02 (GO TO B-3. e.)**

b. **Would you (and your family) be willing to pay (an additional) $2S each year in higher taxes and prices for products that companies sell to raise the water quality from level "D" to level "C", where game fish can live in it and it is improved for other activities? CIRCLE NUMBER.**

YES 01

NO 02

IF YES, INCREASE THE DOLLAR AMOUNT IN **$5 INCREMENTS UNTIL A "NO" ANSWER IS GIVEN. E. G., "Would you be willing to pay $30 (more) esch year to raise the water quality from level 'D' to level 'C' ?" ETC. WHEN A "NO" ANSWER** IS GIVEN, RECORD DOLLAR AMOUNT **OF** LAST "YES" ANSWER .

IF NO, DECREASE THE DOLLAR AMOUNT IN **$5 INCREMENTS UNTIL A "YES" ANSWER IS GIVEN. E.G. , "Would you be willing to pay $20 (more) each year to raise the water quality from level 'D' to level 'C'?"** ETC. WHEN **A "YES" ANSWER** IS GIVEN , RECORD DOLLAR AMOUNT.

$ ____________ DOLLARS (IF ANY AMOUNT, GO TO B-3. c.; **IF ZERO DOLLARS IS** FINAL AMOUNT, GO TO B-3. d.) (37-.39J

c. **Would you (and your family) be willing to pay an additional $2S ●ach year in higher taxes and prices for products that companies sell to raise the water quality from level "C" to level "B", where you can swim in it and it is improved for other activities? CIRCLE NUMBER.**

YES 01

NO 02

1

IF YES, **INCREASE THE DOLLAR AMOUNT IN** $5 INCREMENTS UNTIL A "NO" ANSWER IS **GIVEN. E. G., "Would you be willing to pay $30 more each year to raise the water quality from level 'C' to level 'B'?" ETC. WHEN A '*NO" ANSWER IS GIVEN ,. RECORD DOLLAR MOUNT OF LAST "YES"** ANSWER.

IF NO, DECREASE THE DOLLAR AMOUNT IN *$5* INCREMENTS UNTIL **A "YES" ANSWER IS GIVEN. E. G., "Would you be willing to pay $20 more each year to raise the water quality from level 'C' to level 'B+?" ETC. WHEN A "YES" ANSWER IS GIVEN , RECORD DOLLAR AMOUNT.**

$ ____________ DOLIARS (GO TO B-4) *(40-42)*

d. **Would you (and your family) be willing to pay $2S each year in higher taxes and prices for products that companies sell to raise the water quality from level "D" to level "B", where you can swim in it and it is improved for other activities? CIRCLE NUMBER.**

YES 01

NO 02

IF YES, INREASE THE DOLLAR AMOUNT IN $5 INCREMENTS UNTIL A "NO" ANSWER IS GIVEN. E. G., "Would you be willing to pay $30 each year to raise the water quality from level 'D' to level 'B'?" ETC. WHEN A "NO" ANSWER IS GIVEN, RECORD DOLLAR AMOUNT OF LAST "YES" ANSWER.

IF NO, DECREASE THE DOLIAR AMOUNT IN $5 INCREMENTS UNTIL A "YES" ANSWER IS GIVEN. E. G., "Would you be willing to pay $20 each year to raiae the water quality from level 'D' to Level 'B'?" ETC. WHEN A "YES" ANSWER IS GIVEN, RECORD DOLLAR AMOUNT.

$ ____________ DOLLARS

(IF ANY MOUNT IN a., GO TO B-4;
IF ZERO DOLLARS IN a. AND:
. ANY AMOUNT IN d., GO TO B-4. d.;
. ZERO DOLLARS IN d., GO TO B-3. e.)

(43-45)

e. **We have found in studies of this type that people have a lot of different reasons for answering as they do. Some people felt they did not have enough information to give a dollar amount, some did not want to put dollar values on environmental quality, and some objected to the way the question was presented. Others gave a zero dollar amount because that was what it was worth to them.**

Which of these reasons best describes why you answered the way you did? REPEAT REASONS IF NECESSARY AND CIRCLE NUMBER.

NOT ENOUGH INFORMATION . . 01

DID NOT WANT TO PLACE DOLLAR VALUE 02

OBJECTED TO WAY QUESTION WAS PRESENTED 03

THAT IS WHAT IT IS WORTH 04

OTHER (SPECIFY) . . 05

____

(GO TO B-6)

(46-47)

OMB # 2000-0381
Approval Expires: 9/20/82

ESTIMATING BENEFITS OF WATER QUALITY
QUESTIONNAIRE

Form No. 02
(1)

I. IDENTIFICATION INFORMATION

A. **Study No.** ☐☐☐☐ *(2-6)*

B. **PSU/Segment No.** ☐ - ☐☐☐☐☐ *(8-13)*

C. **Housing Unit No.** ☐☐☐ *(15-17)*

D. **Interviewer ID No.** ☐☐☐☐☐☐ *(Skip)*

E. **Sample Individual Roster Line No.** m (19-20)

F. **Questionnaire Version** D (22)

II. INTRODUCTION

IF THE **ENUMERATION RESPONDENT IS ALSO THE SELECTED SAMPLE INDIVIDUAL, CONTINUE YOUR INTRODUCTION TO THE STUDY BY READING TEE SECOND PARAGRAPH BELOW. IF THE SAMPLE INDIVIDUAL IS SOMEONE OTHER TRAN THE ENUMERATION RESPONDENT, READ THE ENTIRE INTRODUCTION BILLOW.**

Hello, I'm (NAME) *from* **the Research Triangle Institute in North Carolina. We are doing a study for a government agency to study levels of water quality and some outdoor recreational activities people take part in both near and on ponds, lakes, streams and rivers in the Monongahela River Basin. You have been randomly selected to participate in the study.**

Your participation is ● mtirely voluntary and you may refuse to answer any questiona. Because only a small number of people are being selected for the study, the participation of each person selected is extremely important. Most of the questions have to do with your attitudes and opinions and there are no right or wrong answers. The information which you provide will be kept strictly confidential and will be used only for overall statistical results. If you would like, we will send you a summary of the results of the study.

CHECK APPROPRIATE BOX BELOW AND SF "YES" PRINT DESPONDENT'S MAILING ADDRESS.

RESULTS REQUESTED: YES ☐ NO ☐

Mailing Address

____
Number/Street/RFD **Apt. No.**

______________________________________ ☐☐☐☐☐
City/State ZIP

INTERVIEW START TIME: ________________ **AM / PM**

B-3 a. To *you* (and your family), would it be worth $125 each year in higher taxes and prices for products that companies sell to keep the water quality in the Monongahela River from slipping back from level "D" to level "E"? CIRCLE NUMBER.

YES 01

NO 02

IF YES, INCREASE THE DOLLAR AMOUNT IN $10 INCREMENTS UNTIL A "NO" ANSWER IS GIVEN. E.G., "Would it be worth $135 each year to keep water quality from slipping from level 'D' to 'level 'E'?" ETC. WHEN A "NO" ANSWER IS GIVEN, RECORD DOLLAR AMOUNT OF LAST "YES" ANSWER.

IF NO, DECREASE THE DOLLAR AMOUNT IN $10 INCREMENTS UNTIL A "YES" ANSWER IS GIVEN. E. G., "Would it be worth $115 each year to keep water quality from slipping from level 'D' to-level- 'E'?" ETC. WHEN A "YES" ANSWER IS GIVEN, RECORD DOLLAR AMOUNT.

$ ____________ DOLLARS (IF ANY AMOUNT. GO TO B-3. b.: IF ZERO DOLLARS IS FINAL AMOUNT , ASK .) (34-36)

Would it be worth something to you (and your family) to raise the water quality level from level "D" to a higher level? CIRCLE NUMBER .

YES . . . . 01 (GO TO B-3. b.)

No . . . . 02 (GO TO B-3. e.)

b. **Would you (and your family) be willing to pay (an additional) $125 each year in higher taxes and prices for ptoducts that companies sell to raise the water quality from level** "D" to level "C", where **game fish can live in it and it is improved for other activities?** CIRCLE NUMBER.

YES 01

NO 02

IF YES, INCREASE THE DOLLAR MOUNT IN $10 INCREMENTS **UNTIL A "NO" ANSWER IS GIVEN. E. G., "Would you be willing to pay $135 (more) each year to raise the water quality** from level 'D' to level 'C'?" ETC. WHEN **A "NO" ANSWER IS GIVEN, RECORD DOLLAR AMOUNT OF** LAST "T'S" ANSWER.

IF NO, DECREASE THE DOLLAR AMOUNT IN **$10 INCREMENTS UNTIL A "YES" ANSWER IS GIVEN. E. G., "Would you be willing to pay $115 (more) ● ach *year* to raise the** water **quality from level** 'D' to level **'C'?"** ETC. WHEN A "YES" ANSWER **IS GIVEN, RECORD DOLLAR AMOUNT.**

$ ____________ DOLLARS (IF ANY AMOUNT, GO TO B-3. c.; IF ZERO DOLLARS IS FINAL MOUNT, Go TO B-3. d.) **(37-39)**

c. **Would you (and your family) be willing to pay an additional $125 each year in higher taxes and prices for products that companies sell to raise the water quality from level "C" to level "B", where you can swim in it and it is improved for other activities? CIRCLE NUMBER.**

YES 01

NO 02

IF YES, INCREASE THE DOLLAR AMOUNT IN $10 INCREMENTS **UNTIL A "NO" ANSWER IS GIVEN. E.G. , "Would you be willing to pay $135 more each year to raise the water quality from level ' C' to level 'B'** ?" ETC. WHEN A "NO" ANSWER **IS GIVEN, RECORD DOLLAR AMOUNT** *OF* **LAST "YES"** ANSWER .

IF NO, DECREASE THE DOLLAR AMOUNT IN **$10 INCREMENTS UNTIL A "YES" ANSWER IS GIVEN. E.G. , "Would you be willing to pay $115 ❑ore each year to raise the water quality from level ' C' to level 'B'?" ETC. WHEN A "YES" ANSWER IS** GIVEN , RECORD DOLLAR AMOUNT.

$ ____________ **DOLLARS (GO TO B-4)** *(40-42)*

d. **Would you (and your** family) be willing to pay $ 125 each year in higher **taxes and prices for products that companies sell to raise the water quality from level "D" to Level "B", where you can swim in it and it is improved for other activities? CIRCLE NUMBER .**

YES 01

NO 02

***IF* YES, INCREASE THE** DOLLAR AMOUNT IN **$ 10 INCREMENTS UNTIL** A **"NO" ANSWER** IS GIVEN. **E.G. , "Would you be willing to pay $135 ●ach year to raise the water quality from level 'D' to level** 'B'?" 'ETC. WHEN ***A "NO" ANSWER* IS GIVEN , RECORD DOLLAR AMOUNT *OF* LAST "YES" ANSWER.**

1

IF NO, DECREASE THE DOLLAR MOUNT IN $10 INCREMENTS UNTIL A "YES" ANSWER IS **GIVEN. E. G., "Would *you* be willing to pay $115 each year to raise the water quality from level 'D' to level 'B'?'~ ETC. WHEN A "YES" ANSWER IS GIVEN, RECORD DOLLAR AMOUNT .**

$ ____________ DOLLARS

IF ANY AMOUNT IN a., GO TO B-4;
IF ZERO DOLLARS IN a. AND;
• ANY AMOUNT IN d., GO TO B-4. d.;
. ZERO DOLLARS IN d., GO TO B-3. e.

(43-4s)

e. **We have found in studies of this type that people have a lot o different reasons for answering as they do. Some people felt the did not have enough information to give a dollar amount, some di not want to put dollar values on environmental quality, and** som **objected to the way the question was presented. Others gave a zer** dollar amount because that was what it was worth to them.

Which of these reasons best describes why you answered the way yo did? REPEAT REASONS IF NECESSARY AND CIRCLE NUMBER.

NOT ENOUGH INFORMATION . . 01

DID NOT WANT TO PLACE DOLLAR VALUE 02

OBJECTED TO WAY QUESTION WAS PRESENTED 03

THAT IS WNAT IT IS WORTH . 04

OTHER (SPECIFY) - . . . . - 05

____

(GO TO B-6)

(46-471

PART 2

SUGGESTIONS FOR IMPROVING THE QUESTIONNAIRE FOR FUTURE USE

Any survey questionnaire can be improved based on the additional information learned in the execution of the survey. This questionnaire is not an exception. One of the most significant changes would amend the word "additional" to the introduction of Question B-7 to clarify that the bid amount is in addition to the amounts previously bid. It is also unclear whether the supply uncertainty dimension added in this question is effectively expressed. This could be improved with a couple of clarifying sentences.

The introduction to Question B-5 could be improved by better explaining how water quality might be worsened only for some weekends. For example, a sentence describing "the effect of higher water temperatures in the summer months could reduce water quality only in that part of the year" might clarify the supply uncertainty that is intended in this question.

The explanation and introduction to the contingent ranking format is too brief. While this may be minimized by the respondent's familiarity with water quality from the other contingent valuation questions, it would require expansion for an application as an independent format. This introduction could also explain in more detail the relation between water quality levels and the amounts paid.

There is a slight difference in wording between Versions A and B and C and D as a result of a word processing error. The phrase "where it is not even clean enough for boating" was inadvertently omitted from Question B-3a in Versions C and D. The water quality ladder would have shown that E was not suitable for boating, so the potential bias here is likely small but, nonetheless, could be avoided in future use.

Finally, some changes might be useful in the visual aids. The cards in the contingent ranking should be same size as the other aids to make them easier to handle. For consistency with the other aids, the value card could have been done in bolder print to make it stand out. There is some debate that a visual aid describing the payment vehicle might have made it clearer to people how they currently pay for water quality. On the other side of this argument is the thinking that this may actually increase the respondents' confusion.

In summary, the questionnaire performed well for most of the key questions, but some relatively minor changes might have made it even better. The question responses most affected by the change are the existence value responses in Question B-7.

APPENDIX E

TECHNICAL WATER QUALITY MEASURES: AN ECONOMIST'S PERSPECTIVE

E.1 INTRODUCTION

A discussion of water quality measurement should define the term water quality, including descriptions of the various attributes that determine quality. Although seldom together, several disciplines have repeatedly explored this issue, and a significant amount of literature is relevant to the questions that arise in benefit estimation. This appendix discusses several of these questions.

E.2 AN OVERVIEW OF TECHNICAL WATER QUALITY MEASURES"

E.2.1 Introduction

The following sections briefly describe technical measures of water quality. Sections E.2.2 and E.2.3 discuss freshwater systems, focusing on their characteristics and their ability to assimilate effluents. Section E.2.4 discusses commonly used parameters, noting their importance in an ecosystem, their measurement, and the ability of individuals to perceive their changes.

E.2.2 Water Quality in Freshwater Systems

Freshwater areas are intricate systems differing in attributes and causal relationships. Freshwater system descriptions are complicated by climate, geography, land use, water management, and existing plants and animals. Because these particular characteristics are usually unknown, actual physical relationships cannot be determined. Descriptions are further complicated when scientific analysis cannot measure deleterious long-term or synergistic effects in a natural setting.

Freshwater systems are either lentic systems, which contain standing water such as lakes, or lotic systems,which contain running water such as streams and rivers. However, classifying a system as lentic or lotic can be difficult when natural impoundments, dams, and reservoirs occur in either. In addition, while the basic nutrient cycles are the same for both systems, life cycles and pollution effects differ considerably.

The scope of this project limits discussion only to lotic systems. Impoundments are considered due to their general dynamic nature. However, because the unique lentic system characteristics sometimes appear in natural and manmade impoundments, problems common to both system types are also discussed.

E.2.3 Assimilative Capacity

The ability of a lotic system to assimilate effluents determines actual pollution levels. Assimilative capacity is usually defined with respect to the absence of deleterious effects with a given level of discharge into a receiving water. However, any materials discharged into the water have an effect. The major problem is one of identifying and measuring these changes and of determining when they become deleterious. An effluent's effect on the environment is influenced by time period, amount of available oxygen, plant nutrients, and locational characteristics.

Daily and seasonal variation in the speed of nutrient cycling are major determinants of an effluent's effect on water quality. Lotic systems derive most of their nutrients from soil runoff, causing primary productivity to vary seasonally. As land nutrient and groundwater levels vary, so does the lotic environment's assimilative capacity. Available sunlight is the primary source of daily variation, with the peak rate of photosynthesis in the afternoon hours causing peak levels of dissolved oxygen.

Assimilative capacity is commonly measured by the availability of dissolved oxygen. Because ail aquatic animal life depends on dissolved oxygen, low dissolved oxygen levels may cause a reduction in species diversity and number. Some effluents reduce dissolved oxygen because they change the rate of photosynthesis, the volubility of oxygen, and the diffusion of atmospheric oxygen or they increase aerobic bacteria activity.

Existing plant nutrients also determine the effect of effluents. Each ecosystem has a defined nitrogen-phosphorus ratio, and all organisms within the system can use nutrients only in this ratio. When an effluent increases nutrient levels, a natural growth limit is eliminated, resulting in excessive plant growth, which eventually decomposes and decreases dissolved oxygen.

Long-term changes in assimilative capacity occur due to an aging process. As erosion takes place, headwaters tend to migrate upstream, as will plant and animal communities. Erosion is also responsible for increases in suspended solids, which deteriorate and affect the composition of the river bottom over time.

E.2.4 Water Quality Parameters

The capacity of a water system to accommodate uses may be defined by a series of hydrological, physical, chemical, and biological parameters. These parameters are relevant in explaining the effects of an effluent on the equilibrium and existing conditions. Both relative and absolute measurements are important in evaluating parameters. No single parameter can be used as an adequate measure of water quality, yet in many cases focusing on one parameter is dictated by data limitations. Several types of parameters descri b. water quality, and a brief discussion of each follows.

Hydrological Parameters

Hydrological parameters determine the level of physical, chemical, and biological parameters. These parameters characterize the atmosphere and catchment area, and care is required in placing the analysis in a particular hydrological process. Consideration should therefore be given to climate, properties of air, precipitation, erosion, and vegetation.

Most studies that attempt to measure water quality do not explicitly consider hydrological parameters. Care is taken only to place measurements in a particular season. For example, flow is often described as important but not considered directly. This treatment can be explained by a lack of data on how often hydrological parameter changes occur and their synergistic effect on the level of other parameters. A possible methodology to include these parameters would be to use water quality modeling. This technique, however, requires large amounts of information and time.

Physical Parameters

Physical parameters are commonly used water quality measures. However, their values vary significantly due to seasonal and diurnal patterns and site-specific characteristics. Readings may not be applicable to wide areas due to these variations. These parameters include the following:

<u>Turbidity</u> is caused by the presence of suspended solids. These solids are usually a variety of substances influenced by man-made and natural occurrences. Increases in suspended solids will affect the level of photosynthesis as transparency is decreased. Also, as settling occurs, eggs and larva may be suffocated, affecting fish reproduction and species diversity. Water turbidity is usually measured by a Secchi disk. This disk is lowered into the water until it disappears, and the resulting depth is recorded. Alternatively, the Jackson Turbidity Unit can be used. Regardless of the measurement technique, individual perceptions of turbidity are thought to be generally correlated with measured levels, explaining its common use in water quality studies. Unfortunately, little is known of how sensitive individuals are to small turbidity changes and what importance this has in their decisionmaking.

<u>Color</u> is important in determining both transparency and aesthetics of water. Water may contain a variety of compounds that change the amount of sunlight allowed in a water column, resulting in a change in the photosynthesis rate. Color is usually determined by visual comparison to a group of standard colors. The use of this parameter in water quality studies is rare due to the lack of consistent measurement over time and among sites. The link between color and individual perceptions is also not well known.

<u>Temperature</u> is a major determinant of the level of biological and chemical activity because temperature changes also cause a change in the equilibrium of a water system. Lotic systems are greatly affected by

atmospheric temperature and usually do not contain any thermal stratification. For these reasons organisms are usually tolerant of large temperature changes. When impoundments occur in the lotic environment, temperature stratifications do occur, inhibiting the availability of dissolved oxygen at certain levels. Temperature readings are taken at various depths with a reversing thermometer or bathythermograph. Simple temperature readings are not a good indicator of water quality. A more appropriate measure would be deviation from the norm caused by man-made and natural infractions. A change in temperature is usually perceived through indirect changes such as algae growth, changes in fish population, and physiological disturbances in swimmers.

Odor and taste measure the presence of industrial discharges, microscopic organisms, and vegetation. These factors are usually the result of industrial discharge or aquatic decomposition. The measurement of odor is determined by concentration levels of various compounds in a sample. Effects of odor are difficult to measure because perceptions vary depending on the individual and distance to the water.

Chemical Parameters

Chemical parameters characterize natural and man-made components of a particular water sample. Reported results are often misleading because the parameters may not be measured from a desired area. The choice of parameters and sample sites usually is based on pollutants expected due to regional and man-made characteristics. Also, cause and effect relationships are not precisely known in the scientific community nor are changes well perceived by individuals. Thus, we cannot determine exact relationships between parameters and water quality. Usually only the direction of change in water quality is known. Common chemical parameters are as follows:

Dissolved oxygen measures the intensity of organic decomposition and the ability of self purification. Dissolved oxygen is necessary for respiration of plants and animals and aerobic decomposition. Concentrations of dissolved oxygen are increased with photosynthesis and atmospheric reaeration. Decreases are caused by vitrification, biological oxygen demand, and benthal oxygen demand. Many species are not tolerant of low levels of dissolved oxygen, and offensive odor may also occur as decomposition occurs without the presence of oxygen. Dissolved oxygen is expressed in terms of mg/liter or percent saturation. Extensive work has been completed on fish populations and levels of dissolved oxygen. These controlled experiments relate fish reproduction rates to minimum dissolved oxygen requirements for various species.

Total dissolved solids represent the concentration of nondegradable wastes in a water sample. These solids may be toxic to the surrounding food chain, but little is known about this relationship. Concentrations are usually in terms of mg/liter.

pH is an index of the acidic-basic relationship of various mineral and basic substances. Under natural conditions, pH ranges from 5.0 to 8.6 on a scale of 1 to 14. Heavily polluted water may cause a low pH (i.e. , an increased concentration of acid). Existing plant and animal life may not be tolerant of severe pH changes. A pH change generally results in a smaller variety of organisms. Recreation use of water usually requires a pH in the range occurring in natural conditions. However, swimming may require a narrow range of 6.5 to 8.3. Individual perceptions of pH are sensitive only to large changes, though a change may be perceived through eye irritation or touch.

Nitrates are formed by the biochemical oxidation of ammonia. Some stratification occurs naturally, resulting in surface waters having higher concentrations. Increased concentration may indicate fecal pollution in the preceding period. The concentration of nitrates may also indicate the rate of self purification of a water system. Nitrates are usually reported as mg/liter.

Metals present in a lotic environment can be caused by soil drainage. Therefore, seasonal changes will affect the concentration of metals present. Industrial sources of metals include mine pit discharge, ore enriching factories, and iron and steel factories. The effects of several metals such as copper, lead, and mercury are commonly studied and well known. The effects of other metals such as chromium, cadmium, cobalt, and nickel are not as well known. Concentrations are usually reported as mg/liter. Severe concentrations may inhibit development if they are passed to higher members of the food chain.

Surface active agents represent a variety of man-made compounds. These agents or surfactants are usually found in detergents. Concentrations result in the normal breakdown of organic material. More noticeable effects are a bitter taste, a soapy and kerosene odor, and the presence of foam. Concentrations usually are measured in terms of mg/liter.

Pesticides are any substance designed to destroy plant or animal organisms. These compounds enter the water indirectly from runoff and drainage or by direct application. Agriculture is the dominant source of pesticide contamination. Many pesticides have a cumulative effect, causing increased concentrations at higher levels of the food chain. As concentrations increase, the natural development of organisms will be altered. Pesticides include a wide variety of compounds and are usually described in mg/liter. Even though their diversity usually precludes their use as a measure of water quality, pesticides are considered an important indicator of water quality.

Biological Parameters

Biological parameters reveal the quality, size, and type of animal and plant populations within a water system. Data readings vary significantly with the season and flow velocity, but these parameters may give a reliable picture of the average situation since organisms cannot rapidly adapt to change. Individuals do not directly perceive changes in these parameters but notice them through such effects as odor, algae, and resulting illness. These factors are most important to direct contact uses but also apply to secondary recreation. The two important biological parameters are as follows:

- Biological oxygen demand measures the rate of oxygen consumption in a system due to organic decomposition. High levels of organic waste cause an increase in the biological oxygen demand and a resulting decrease in available dissolved oxygen. These rates will differ depending on the state of the matter being decomposed. Since temperature controls the rate of organic activity, it also greatly influences oxygen demand. Biological oxygen demand is generally measured as the amount of oxygen removed from a sample in a 5-day period and is an important part of most water quality determinations. However, sample readings may not be comparable due to changes in assimilative capacity. For example, a reading may have a large value and yet have little effect on water quality due to characteristics such as large available dissolved oxygen and strong flow.

- Microbiological parameters determine the presence of waterborne disease. The parameters would include bacteria, viruses, and algae. Both bacteria and viruses may be excreted in the feces of infected animals. The most common parameter of fecal contamination is the test for coliform bacteria expressed as number of bacteria per liter. Limits are currently set on fecal coliform depending on the use of the river. The presence of bacteria and viruses does not affect the appearance of the water. Except at high levels, algae is not toxic but may indicate overfertilization of the system by man or other mammals. Algae may be considered a pollutant since it is readily noticed in water.

E.3 ISSUES IN DETERMINING WATER QUALITY

E.3.1 Introduction

Several issues arise in attempts to define water quality, the most important of which involve the uses of a water system as they affect quality and the selection of an appropriate site. A discussion of these two issues follows, including a brief description of how they relate to this study.

E.3.2 Water Quality and Use

Water quality is directly dependent on current and future uses of a sit.. Common use categories are drinking, swimming, fishing, boating, and industrial. This list is an obvious simplification as it does not recognize the attributes desirable for each use. The use of water for drinking, for example, may occur within a wide range of attributes given various levels of water treatment. The inability to define these attribute ranges causes oversimplification when water quality is measured over various uses.

Uses of a water system are related to each other in a spatial and temporal sense. As the level of one use changes, the benefits derived from competing uses will also change. This relationship is not well defined because it depends on several variables, including the particular uses considered, characteristics of the area, and the time frame considered. In some instances, the relationship may depend on differential preferences of the potential users (e.g. , teenagers and young families may desire a crowded beach while honeymooners and older people may prefer an uncrowded beach), and, in extreme cases, uses may be completely independent or mutually exclusive.

To ensure the same uses at each site in the travel cost approach, this study used only U .S. Army Corps of Engineer areas. Using only these areas eliminates part of the problem of defining uses, but it does not account for competing uses. Ideally, more consideration should be given to variation in uses between sites and their relationship to each other.

E.3.3 Water Quality Within an Area

Water quality is related to the physical boundaries of the study area in two ways: boundaries determine both the physical attributes and the scientific parameters to consider. In turn, physical attributes determine the uses allowed and the interrelationship between uses. For example, the presence of a dam increases the damage caused by an industrial effluent on fish populations.

The determination of the appropriate scientific parameters is subject to the continuous nature of water quality. As these measurements vary between measuring sites, the problem becomes more complex. Quality of water to a user is determined by the immediate and surrounding area. How to incorporate these readings is not clear. Consideration should be given to uses involved, as well as the physical relationship between areas. This issue is clouded by incomplete data when water quality is actually measured.

Data availability ultimately constrains the determination of the study area. The locations of existing monitoring sites are based on a variety of concerns such as location of fisheries, effluents present, and convenience. Quite often the measurements obtained do not conform to the desirable study requirements. Hence, the use of these data may bias results depending on site proximity to the study area and the use being considered.

E.4 MEASUREMENT OF WATER QUALITY

E.4.1 Introduction

A useful measure of water quality would be a universal number or index that can compare uses and scientific parameters. Both individual perceptions of parameters and scientific measures of parameters could be used individually or to compare to an index. However, assigning the appropriate weights to each measure is a difficult task. A brief discussion of advantages to various methods to describe water quality follows.

E.4.2 Human Perceptions and Water Quality Measurement

Individual perceptions play an important role in water quality determination, but consistent measurement of perceptions is a major problem. Studies have shown that perceptions usually vary with questionnaire design information provided and sample population. Binkley and Hanemann [1978] found that respondents base evaluations of water quality on incorrect information. Ditton and Goodale [1973] found that respondents tended to describe areas closest to their residence, which causes large variations in the water quality rating over the entire study area. Moreover, changes in other site attributes limit the ability to draw general conclusions as to the effects of changes in water quality alone. On the other hand, Bouwes and Schneider (1979) found reasonably good correlation between perceptions and the scientifically based lake condition index.

Some differences in perceptions have been attributed to characteristics of the respondents. Barker [1971] found that users of an area tend to rate water quality more favorably than nonusers. Ditton and Goodale [1973] determined that swimmers' perceptions of water quality differed from fishermen's, both in terms of their ratings of water quality and the relative importance of individual features.

E.4.3 Technical Water Quality Measurement

Scientifically measured parameters are usually good indicators of water quality changes. Unlike individual perceptions, the technical water quality tests are usually comparable over time and between sites. Determination of important parameters is difficult, however, since most scientific information is obtained only through controlled experiments. Changes in water quality caused by parameters are difficult to determine because particular site characteristics must be known to determine an expected change, even in the short run. In addition, long-term and synergistic effects also usually cannot be determined because of poor information.

E.4.4 Water Quality Indexes

An ideal water quality measure would combine scientifically measured parameters, individual perceptions, and alternative uses of an area. Unfortunately, these measures require considerable information, and their components may vary between sites. In lieu of complete information, many studios have used approaches that rely on individual parameters or indexes to determine water quality. While most studies have used one or more individual parameters without determining their relative importance, other studies have used the index approach to solve several of the problems noted above. Thus, while far from perfect,the index approach does represent a tractable method of relating water quality to users, perceptions, and scientific judgment.

E .4.4.1 The National Sanitation Foundation Index

The ideal measure of water quality would incorporate scientific parameters, public perception of the water, and potential uses of the water. As an attempt to incorporate these considerations, the National Sanitation Foundation (NSF) index is a constructive approach to several problems in water quality measurement. A composite of nine parameters, the NSF index was developed through several questionnaires given to individuals with water quality experience. Respondents first selected parameters they felt were important to water quality. Followup contacts were then made to give the previous group responses to the respondents and to allow them to change their initial responses. A rating of these parameters in terms of water quality and synergistic effects was then developed based on these responses. The final parameters chosen included dissolved oxygen, fecal coliform density, pH, 5-day biological oxygen demand, nitrates, phosphates, temperature, turbidity, and total solids.

The next step in developing the NSF index required the development of water quality curves for each parameter. These curves represent the expected result of parameter concentrations on water quality and must be combined with the relative weights derived from the respondents' rankings of each parameter. These quality curves and weights constitute the final components of the index. More details on this index can be found in EPA [1982].

Researchers have applied the NSF index in a number of studies. The Us. Environmental Protection Agency (EPA) applied the NSF index to the Kansas River basin to determine its effectiveness, including an appraisal of sampling and computing difficulties. The Kansas River basin, a wide, shallow river of moderate velocity, has light industry and receives treated municipal wastes from over 40 cities and towns. EPA calculated two forms of the NSF index with almost 600 water samples from over 26 sites. Calculated index values were consistent with researchers' attitudes toward the various reaches of the river.

The index calculations were also used to examine several other concerns. For example, the correlations between several variables were measured to test the validity of substituting parameters when certain data do not exist. The study determined that suspended solids can be substituted for turbidity and total coliform for fecal coliform.

The NSF index provides a scientifically based method of linking changes in water quality to the effects of those changes. The index, however, does not provide a linkage to individual perceptions of water quality changes and cannot differentiate threshold values for specific uses like fishing or swimming.

E. 4.4.2 Resources for the Future Water Quality Ladder

A significant problem with the NSF index is that it does not take into account potential uses for a particular body of water. At Resources for the Future (RF F), Vaughan in Mitchell and Carson [1981] used a variation of the NSF index to determine minimum levels of water quality for various uses. Specifically, Vaughan's index used five NSF index parameters chosen on the

Table E-1. Water Quality Classes by Parameter and Index Values

Water quality use designation	Fecal coliform (#/100 mL)	Dissolved oxygen[a] (mg/L)	5-Day BOD (mg/L)	Turbidity (JTU)	pH	Ladder value
	Measurable water quality characteristics					
Acceptable for drinking without treatment	o	7.0 (90)	o	5	7.25	9.5
Acceptable for swimming	200	6.5 (83)	1.5	10	7.25	7.0
Acceptable for game fishing	1,000	5.0 (64)	3.0	50	7.25	5.1
Acceptable for rough fishing	1,000	4.0 (51)	3.0	50	7.25	4.5
Acceptable for boating	2,000	3.5 (45)	4.0	100	4.25	2.5

[a]Numbers in parentheses are percent saturation at 85° F.

basis of judgment and data availability: fecal coliform, dissolved oxygen, biological oxygen demand, turbidity, and pH. As shown in Table E-1, Vaughan associated specific parameter levels with five use designations. He then used a truncated version of the NSF index to place each minimum use designation on an index value range from O to 10 with the final index values for each use classification shown in Table E-1 .

The RFF index provides a valuable link between various parameters and use designations. Even though the parameter choice may be somewhat arbitrary, the parameters neatly map into desirable attributes for a particular use. However, the RFF index does not account for differing individual perceptions that may be easily incorporated with further research. The RFF ladder is used in this study, as shown in Figure 4-5.

E.5 SUMMARY

The questions involved in defining water quality are complex, and there are no clear answers. Water quality studies must jointly determine the parameters to be considered, the uses to be considered, and the definition of the site to be studied. I n addition, each of these issues has many aspects, such as how to define the relationship between uses, and each is subject to the constraint of available data. To date, very little has been done to measure water quality between sites or over time. One exception would be the RF F and NSF indexes, which measure various aspects of water quality and weigh them using informed judgment. Further research in this direction could lead to an index that incorporates individual perceptions and unique characteristics of an area.

APPENDIX F

TRAVEL COST: SUPPORTING TABLES

This appendix contains tables displaying data that support the travel cost analysis presented in Chapter 7. Tables F-1 through F-4 provide additional data for the benefits calculations. Table F-5 shows the tailored models that were estimated for selected sites.

Table F-1. Distribution of Benefit Estimates (Consumer Surplus Loss Avoided) for Loss of Use of the Monongahela River by Income Levels for 33 Sites for Individual Users

	Benefit estimate (1977 dollars)[a]											
Income	0-	10-	20-	30-	40-	50-	60-	100-	150-	200 and		
(1981 dollars)	0	10	20	30	40	50	60	100	150	200	above	Total
0 - 5,000	0	1	0	0	0	0	2	0	1	0	0	4
5,000 - 10,000	1	1	3	1	1	0	1	0	1	0	0	9
10,000 - 15,000	1	0	1	1	0	0	0	0	2	1	0	6
15,000 - 20,000	2	2	0	1	3	0	1	0	2	0	1	12
20,000 - 25,000	1	1	1	1	1	0	0	1	0	0	0	6
25,000 - 30,000	2	1	2	0	0	1	2	0	0	0	1	9
30,000 - 35,000	1	0	0	0	0	0	0	0	3	0	0	4
35,000 - 40,000	0	0	0	1	0	0	2	1	1	0	0	5
40,000 - 45,000	0	0	0	0	0	0	0	1	0	0	0	1
45,000 - 50,000	0	0	1	1	0	0	0	2	0	0	0	4
50,000 and above	0	0	0	1	0	0	0	0	1	0	1	3
Total	8	6	8	7	5	1	10	3	11	1	3	63

[a]To convert to 1981 dollars, multiply the endpoints of the benefit scale by 1.55.

Table F-2. Distribution of Benefit Estimates (Consumer Surplus Loss Avoided) Due to Loss of Use of the Monongahela River by Survey User Income for 33 Sites--Includes Multiple Visits

Income (1981 dollars)	Benefit estimate (1977 dollars)[a]									
	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	Total
0 - 5,000	0	0	0	1	2	0	4	3	4	10
5,000 - 10,000	0	0	0	0	0	0	2	5	4	11
10,000 - 15,000	0	0	0	0	0	0	0	5	3	8
15,000 - 20,000	0	0	1	1	2	0	2	7	5	18
20,000 - 25,000	1	0	1	1	0	1	0	2	0	6
25,000 - 30,000	1	0	1	1	1	4	4	8	2	22
30,000 - 35,000	0	0	0	1	2	0	1	2	1	7
35,000 - 40,000	0	0	0	0	0	0	1	1	1	3
40,000 - 45,000	0	0	0	1	0	0	1	0	1	3
45,000 - 50,000	0	0	0	0	0	0	0	4	0	4
50,000 and above	0	0	0	0	0	0	0	2	0	2
Total	2	0	3	6	7	5	15	39	17	94

[a]To convert to 1981 dollars, multiply the endpoints of the benefit scale by 1.55.

Table F-3. Distribution of Benefit Estimates (Consumer Surplus Increment) Due to Water Quality Improvement: Boatable to Fishable by Survey User Income for 33 Sites--Includes Multiple Visits

Income (1981 dollars)	Benefit estimate (1977 dollars)[a]				
	0-10	10-20	20-30	30-40	Total
0 - 5,000	0	1	7	2	10
5,000 - 10,000	0	0	11	0	11
10,000 - 15,000	0	0	8	0	8
15,000 - 20,000	1	5	12	0	18
20,000 - 25,000	3	3	0	0	6
25,000 - 30,000	5	17	0	0	22
30,000 - 35,000	7	0	0	0	7
35,000 - 40,000	3	0	0	0	3
40,000 - 45,000	3	0	0	0	3
45,000 - 50,000	4	0	0	0	4
50,000 and above	2	0	0	0	2
Total	28	26	38	2	94

[a]To convert to 1981 dollars, multiply the endpoints of the benefit scale by 1.55.

Table F-4. Distribution of Benefit Estimates (Consumer Surplus Increment) Due to Water Quality Improvement: Boatable to Swimmable by Survey User Income for 33 Sites--Includes Multiple Visits

1 ncome (1981 dollars)	Benefit estimate (1977 dollars)[a]						
	o-1o	10-20	20-30	30-40	40-50	50-60	Total
0 - 5,000	0	0	1	2	4	3	10
5,000 - 10,000	0	0	0	0	11	0	11
10,000 - 15,000	0	0	0	5	3	0	8
15,000 - 20,000	0	2	3	13	0	0	18
20,000 - 25,000	1	2	3	0	0	0	6
25,000 - 30,000	3	11	8	0	0	0	22
30,000 - 35,000	3	4	0	0	0	0	7
35,000 - 40,000	3	0	0	0	0	0	3
40,000 - 45,000	3	0	0	0	0	0	3
45,000 - 50,000	4	0	0	0	0	0	4
50,000 and above	2	0	0	0	0	0	2
Tota l	19	19	15	20	18	3	94

[a]To convert to 1981 dollars, multiply the endpoints of the benefit scale by 1.55.

Table F-5. Regression Results of Tailored Models for Selected Sites[a]

Site	Site number	Intercept	T+M cost	Income	Income squared	Age	Sex	RECIMP	Day	R^2	DF	F-ratio
Lock and Dam No. 2 (Arkansas River Navigation System), AR	302	2.63 (7.12)	-0.012 (-2.20)	8.7×10^{-5} (-1.37)	3.1×10^{-9} (1.12)					0.17	37	2.51
		2.39 (8.24)	-0.012 (-2.08)	-1.8×10^{-5} (-1.08)		-0.003 (-0.50)				0.15	37	2.12
		2.25 (8.06)	-0.013 (-2.29)	-1.6×10^{-5} (-0.86)			0.062 (.037)			0.14	37	2.07
		1.94 (6.02)	-0.013 (-2.46)	-1.5×10^{-5} (-0.88)				0.378 (1.62)		0.20	37	3.04
		2.25 (9.41)	-0.010 (-1.67)	-8.5×10^{-6} (-0.45)					-0.209 (-1.30)	0.18	37	2.67
Beaver Lake, AR	303	1.69 (9.09)	-0.007 (-12.46)	-1.2×10^{-5} (0.68)	1.9×10^{-9} (0.51)					0.43	222	57.02
		1.70 (11.98)	-0.007 (-12.10)	-3.8×10^{-6} (-0.84)		-0.003 (-0.92)				0.44	222	57.37
		1.48 (13.17)	-0.007 (-13.04)	-2.3×10^{-6} (-0.51)			0.212 (2.32)			0.45	222	60.05
		1.48 (12.03)	-0.007 (-12.85)	-4.0×10^{-6} (-0.91)				0.191 (1.82)		0.44	222	58.83
		1.74 (16.32)	-0.006 (-11.75)	-1.9×10^{-6} (-0.43)					-0.310 (-3.18)	0.46	222	62.83
Blakely Mt. Dam, Lake Qouachita, AR	307	1.58 (5.59)	-0.008 (-5.14)	6.6×10^{-6} (0.24)	-3.2×10^{-10} (-0.53)					0.24	87	9.13
		1.53 (5.87)	-0.008 (-5.18)	-6.3×10^{-6} (-0.79)		0.005 (0.84)				0.24	87	9.31
		1.69 (9.71)	-0.008 (-5.08)	-7.9×10^{-6} (-1.01)			0.048 (0.31)			0.24	87	9.05
		1.28 (5.95)	0.008 (-5.23)	-9.8×10^{-6} (-1.31)				0.555 (3.00)		0.31	87	12.93
		1.88 (9.22)	-0.007 (-4.89)	-7.0×10^{-6} (-0.92)					-0.275 (-1.56)	0.26	87	10.07

OF = Degrees of freedom.

[a]t-values of no association are shown in parentheses. RECIMP is a binary variable that is 1 if the respondent ccnsiders recreation to be important. Day is a binary variable that Is 1 if the respondent stayed 1 or more days..

Table F-5. (continued)

Site	Site number	Intercept	T+M cost	Income	Income squared	Age	Sex	RECIMP	Day	R^2	DF	F-ratio
Cordell Hull Dam and Reservoir, TX	310	1.97	-0.014	-1.4×10^{-5}	$3.6 \times , 0^{-10}$					0.34	100	17.10
		(8.96)	(-5.94)	(-0.63)	(0.67)							
		1.58	-0.015	2.8×10^{-6}		0.007				0.36	I 00	18.40
		(7.74)	(-6.28)	(0.33)		(1.74)						
		1.65	-0.014	2.4×10^{-6}			0.311			0.37	100	19.52
		(10.41)	(-6.33)	(0.29)			(2.29)					
		1.87	-0.014	5.6×10^{-8}				-0.021		0.34	100	16.88
		(9.14)	(-5.93)	(0.01)				(-0.11)				
		1.88	-0.013	7.4×10^{-6}					-0.208	0.35	100	17.79
		(14.25)	(-5.63)	(0.17)					(-1.35)			
Dewey Lake, KY	312	0.26	-0.002	3.6×10^{-5}	$-3., \times 10^{-10}$					0.18	42	3.16
		(0.64)	(-2.74)	(1.01)	(-0.47)							
		0.16	-0.003	1.9×10^{-5}		0.009				0.21	42	3.70
		(0.55)	(-3.19)	(1.91)		(1.24)						
		0.08	-0.003	2.5×10^{-5}			0,498			0.31	42	6.46
		(0.36)	(-3.67)	(2.74)			(2.89)					
		0.43	-0.002	2.0×10^{-5}				-0.018		0.18	42	3.08
		(2.17)	(-2.91)	(1 .99)				(-0.10)				
		0.54	-0.002	1.9×10^{-5}					-0.359	0.24	42	4.37
		(2.79)	(-1.85)	(1.96)					(-1.78)			
Grapevine Lake, TN	314	1.54	-0.007	3.5×10^{-5}	-5.4×10^{-10}					0.48	88	26.94
		(7.16)	(-8.78)	(1.74)	(-1.36)							
		2.16	-0.006	7.6×10^{-5}		-0.013				0.52	88	31.95
		(13.76)	(-7.89)	(1.59)		(-3.14)						
		1.74	-0.007	8.0×10^{-6}			0.109			0.47	88	26.41
		(13.98)	(-8.85)	(1.59)			(1.00)					
		1.44	-0.007	9.4×10^{-6}				0.392		0.50	88	29.60
		(8.05)	(-9.26)	(1.92)				(2.47)				
		1.80	-0.009	9.2×10^{-6}					-0.296	0.44	88	22.88
		(15.13)	(-6.62)	(1.77)					(-2.36)			

DF = Degrees of freedom.

at-values of no association are shown In parentheses. RECIMP is a binary variable that is 1 if the respondent considers recreation to be important. Day Is a binary variable that Is 1 if the respondent stayed 1 or more days.

Table F-5. (continued)

SIte	Site number	Intercept	T+M cost	Income	Income squared	Age	Sex	RECIMP	Day	R*	DF	F-ratio
Greers Ferry Lake, AR	315	1.49	-0.006	$7,3 \times 10^{-6}$	2.6×10^{-11}					0.28	213	27.07
		(8.04)	(-8. 91)	(0.35)	(0.05)							
		1.61	-0.006	$9,6 \times 10^{-6}$		-0.004				0.28	213	27.66
		(10.63)	(-9.09)	(1.60)		(-1.14)						
		1.45	-0.006	8.4×10^{-6}			0.054			0.28	213	27.20
		(12.25)	(-8.97)	(1.42)			(0.53)					
		1.15	-0.007	9.0×10^{-6}				0.372		0.29	213	29.70
		(6.69)	(-9.34)	(1.55)				(2.39)				
		1.76	-0.006	1.0×10^{-5}					-0.494	0.35	213	38.06
		(15.29)	(-8.80)	(1.92)					(-4.89)			
Grenada Lake, MS	316	1.91	-0.010	2.1×10^{-5}	-1.6×10^{-9}					0.22	72	6.76
		(7.47)	(-4.37)	(0.41)	(-0.63)							
		1.81	-0.009	$-5.(J \times 10^{-6}$		0.005				0.23	72	7.14
		(7.07)	(-4.31)	(-0.32)		(1.13)						
		2.06	-0.009	-1.0×10^{-5}			-0.049			0.22	72	7.36
		(11.44)	(-4.16)	(-0.65)			(-0.32)					
		1.28	-0.010	-9.6×10^{-6}				0.806		0.30	72	10.36
		(4.31)	(-4.62)	(-0.67)				(2.98)				
		2.03	-0.008	-1.8×10^{-6}					-0.419	0.28	72	9.26
		(13.0')	(-3.57)	(-0.12)					(-2.51)			
Lake Washington Ship Canal, WA	320	2.69	-0.004	-1.6×10^{-4}	4.3×10^{-9}					0.35	39	6.95
		(3.27)	(-4.16)	(-2.06)	(2.36)							
		1.10	-0.003	1.6×10^{-5}		-0.005				0.26	39	4.57
		(2.20)	(-2.98)	(0.73)		(-0.52)						
		0.81	-0.004	1.9×10^{-5}			0.234			0.27	39	4.83
		(2.11)	(-3.81)	(0.94)			(0.92)					
		1.00	-0.004	1.7×10^{-5}				-0.079		0.26	39	4.48
		(2.01)	(-3.64)	(0.81)				(-0.24)				
		EQUATION 5 IS NOT OF FULL RANK BECAUSE ALL VISITS WERE DAY VISITS.										
Melvern Lake, KS	322	1.87	.-0.008	-6.7×10^{-5}	1.6×10^{-9}					0.11	41	1.69
		(3.93)	(-1.60)	(-1.36)	(1.5)							

DF = Degrees of freedom.

at-values of no association are shown in parentheses. RECIMP is a binary variable that is 1 if the respondent considers recreation to be important. Day is a binary variable that is 1 if the respondent stayed 1 or more days.

Table F-5. (continued)

Site	Site number	Intercept	T+M cost	Income	Income squared	Age	Sex	RECIMP	Day	R^2	DF	F-ratio
Melvern Lake, KS (con.)	322	1.10	-0.009	4.8×10^{-6}		0.005				0.07	41	1.01
		(2.39)	(-1.72)	(0.36)		(0.57)						
		1.36	-0.008	5.9×10^{-5}			-0.135			0.07	41	0.98
		(4.30)	(-1.69)	(0.43)			(-0.49)					
		0.96	-0.007	5.1×10^{-6}				0.380		0.09	41	1.42
		(2.38)	(-1.46)	(0.39)				(1.21)				
		1.47	-0.008	7.0×10^{-6}					-0.303	0.08	41	1.26
		(4.39)	(-1.62)	(0.52)					(-1.02)			
Millwood Lake, AR	323	1.48	-0.008	1.1×10^{-5}	1.2×10^{-10}					0.25	49	5.41
		(4.82)	(-3.96)	(0.39)	(0.20)							
		0.83	-0.009	2.1×10^{-5}		0.013				0.30	49	7.10
		(2.35)	(-4.45)	(2.57)		(1,96)						
		0.98	-0.009	1.7×10^{-5}			0.691			0.39	49	10.54
		(4.68)	(-4.59)	(2.29)			(3.41)					
		1.30	-0.008	1.7×10^{-5}				0.166		0.25	49	5.55
		(4.60)	(-3.94)	(2.03)				(0.59)				
		1.51	-0.007	1.9×10^{-5}					-0.333	0.28	49	6.39
		(8.13)	(-3.47)	(2.34)					(-1.50)			
Mississippi River Pool No. 3, MN	324	2.12	-0.005	-7.2×10^{-5}	1.4×10^{-9}					0.38	45	9.20
		(3.90)	(-4.22)	(-1.63)	(1.78)							
		1.01	-0.006	4.8×10^{-6}		0.008				0.34	45	7.89
		(1.89)	(-4.53)	(0.55)		(0.74)						
		1.40	-0.006	4.4×10^{-6}			-0.143			0.34	45	7.88
		(4.21)	(-4.44)	(0.50)			(-0.73)					
		0.94	-0.006	3.1×10^{-6}				0.539		0.38	45	9.05
		(2.41)	(-4.97)	(0.37)				(1.69)				
		1.32	-0.006	4.5×10^{-6}					0.036	0.34	45	7.63
		(4.05)	(-4.56)	(0.51)					(0.18)			
Mississippi River Pool No. 6, MN	325	1.23	-0.007	3.1×10^{-5}	-3.5×10^{-10}					0.22	66	6.34
		(3.16)	(-4.31)	(0.88)	(-0.51)							
		1.24	-0.007	1.4×10^{-5}		0.005				0.23	66	6.46

DF = Degrees of freedom.

[a] t-values of no association are shown in parentheses. RECIMP is a binary variable that is 1 if the respondent considers recreation to be important. Day is a binary variable that is 1 if the respondent stayed 1 or more days.

Table F-5. (continued)

Site	Site number	Intercept	T+M cost	Income	Income squared	Age	Sex	RECIMP	Day	R^2	DF	F-ratio
Mississippi River Pool No. 6, MN (con.)	325	(4.19)	(-4.31)	(1.58)		(0.78)						
		1.45 (6.21)	-0.007 (-4.05)	1.3×10^{-5} (1.50)			-0.074 (-0.36)			0.22	66	6.29
		0.98 (3.43)	-0.007 (-3.88)	1.0×10^{-5} (1.20)				0.537 (2.08)		0.27	66	8.08
		1.42 (6.74)	-0.007 (-4.15)	1.4×10^{-5} (1.53)					-0.040 (-0.21)	0.22	66	6.25
Ozark Lake, AR	331	1.53 (5.06)	-0.005 (-4.45)	1.3×10^{-5} (0.32)	-6.2×10^{-10} (-0.58)					0.32	48	7.46
		1.64 (5.25)	-0.005 (-4.40)	-8.6×10^{-5} (-0.63)		0.001 (0.09)				0.31	48	7.30
		1.71 (7.57)	-0.004 (-4.19)	-1.0×10^{-4} (-0.73)			-0.96 (-0.47)			0.32	48	7.40
		1.42 (5.11)	-0.005 (-4.58)	-7.1×10^{-6} (-0.53)				0.285 (1.18)		0.33	48	7.98
		1.80 (9.04)	-0.003 (-3.15)	-2.0×10^{-5} (-1.15)					-0. s41 (-2.15)	0.37	48	9.54
Philpott Lake, VA	333	1.61 (5.17)	-0.009 (-4.56)	4.2×10^{-5} (1.10)	-1.3×10^{-9} (-1.22)					0.39	34	7.28
		2.26 (6.85)	-0.009 (-4.39)	-8.6×10^{-7} (-0.006)		-0.011 (-1.41)				0.40	34	7.53
		2.01 (9.05)	-0.008 (-3.98)	-1.5×10^{-6} (-0.12)			-0.232 (-1.26)			0.39	34	7.33
		1.40 (3.61)	-0.009 (-4.64)	5.5×10^{-6} (0.40)				0.449 (1.48)		0.40	34	7.64
		1.92 (10.03)	-0.007 (-3.61)	3.4×10^{-6} (0.27)					-0.483 (-2.43)	0.46	34	9.60
Pine River, MN	334	0.19 (0.50)	-0.001 (-0.90)	5.0×10^{-5} (1.64)	1.1×10^{-9} (-1.90)					0.08	71	2.16
		0.69 (2.69)	-0.002 (-1.36)	-6.6×10^{-6} (-0.95)		0.004 (0.62)				0.04	71	1.04

OF = Degrees of freedom.

at-values of no association are shown in parentheses. RECIMP is a binary variable that is 1 if the respondent considers recreation to be important. Day Is a binary variable that is 1 if the respondent stayed 1 or more days,

Table F-5. (continued)

Site	Site number	Intercept	T+M cost	1 ncome	Income squared	Age	Sex	RECIMP	Day	R^2	DF	F-ratio
Pine River, MN (con.)	334	0.82 (4.51)	-0.002 (-1.06)	-6.5 x 10^{-6} (-0.92)			-0.092 (-0.20)			0.04	71	0.93
		0.53 (2.36)	-0.002 (-1.25)	-8,2 x 10^{-6} (-1.19)				0.363 (1.91)		0.08	71	2.17
		1.07 (3.42)	-0.002 (-1.31)	-5.3 x 10^{-6} (-0.75)					-0.291 (-0.99)	0.05	71	1.25
Proctor Lake, TX	337	2.13 (8.57)	-0.013 (-6.48)	-6.8 x 10^{-6} (-0.25)	1.5 x 10^{-10} (0.32)					0.54	48	18.61
		1.81 (6.57)	-0.013 (-7.50)	3.7 x 10^{-6} (0.53)		0.005 (1.11)				0.55	48	19.43
		1.99 (12.86)	-0.014 (-7.86)	-3.0 x 10^{-7} (-0.04)			0.273 (1.81)			0.57	48	20.89
		?.94 (7.54)	-0.013 (7.41)	1.3 x 10^{-6} (0.20)				0.139 (0.61)		0.54	48	18.61
		2.06 (11.79)	-0.013 (-7.09)	1.2 x 10^{-6} (0.17)					0.010 (0.05)	0.54	48	18,54
Sardls Lake, MS	340	2.07 (13.95)	-0.004 (-3.95)	-2.9 x 10^{-5} (-1.78)	8.6 x 10^{-10} (2.18)					0.07	201	5.13
		1.91 (13.52)	-0.003 (-3.07)	3.3 x 10^{-6} (0.57)		-0.003 (-0.97)				0.05	201	3.79
		1.84 (18.39)	-0.003 (-3.14)	4.5 x 10^{-6} (0.81)			-0.057 (-0.68)			0.05	201	3.63
		1.12 (7.57)	-0.003 (-3.93)	4.2 x 10^{-6} (0.80)				0.767 (5.58)		0.18	201	14.38
		1.88 (20.69)	-0.003 (-3.50)	7.5 x 10^{-6} (1.32)					-0.208 (-2.61)	0.08	201	5.84
Whitney Lake, TX	344	1.50 (8.68)	-0.003 (-1.70)	-7.7 x 10^{-6} (-0.45)	2.3 x 10^{-10} (0.67)					0.02	198	1.30
		1.40 (8.79)	-0.002 (-1.75)	3.3 x 10^{-6} (0.73)		0.0003 (0.09)				0.02	198	1.15
		1.34 (11.61)	-0.003 (-1.83)	2.9 x 10^{-6} (0.64)			0.160 (1.50)			0.03	198	1.91
		1.23 (9.22)	-0.003 (-1.74)	1.6 x 10^{-6} (0.35)				0.271 (2.19)		0.04	198	2.78
		1.83 (14.50)	-0.003 (-2.09)	3.4 x 10^{-6} (0.81)					-0.601 (-5.61)	0.15	198	11.81

DF = Degrees of freedom

• t-values of no association are shown in Parentheses. RECIMP is a binary variable that is I if the respondent considers recreation to be important. Day is a binary variable that is 1 if the respondent stayed 1 or more days.

APPENDIX G

ALTERNATIVE REGRESSION MODELS

This appendix provides a detailed listing of the alternative specifications of regression models. Listings are given for both the survey and travel cost models.

Table G-1. Independent variable combinations used in option price, user value, and option value regressions. Dependent variables are dollar bids given for” changes in water quality.

Sex	Age	Education	Income	Dummy Variables to Denote Survey Version	Bidding vs. Non-Bidding Game Dummy	Length of Residence	Attitude Index[1]	Attitude towards cost Dummy	User Dummy	Water Quality Rating Dummy[2]	Dummy variables to denote Interviewer	Dummy variables to denote Profession	Dummy Variables to denote SIC Industry
X	X	X	X	X			X				X		
X	X	X	X	X			X		X				
X	X	X	X	X								X	
	X	X	X	X			X						
X	X		X						X			X	
		X		X			X			X			
X	X		X										X
		X		X			X		X				
X	X		X							X			X
X		X		X				X			X		
X	X	X	X	X				X	X				
			X							X	X		
X	X	X		X				X				X	
			X						X				
X	X	X		X				X		X		X	
			X										X
X	X	X		X				X	X				
			X							X			X
X	X	X		X			X						
			X										
X	X	X		X			X		X				
			X			X							
X	X	X											
			X	X		X			X				
X	X	X											
			X		X						X		

(continued)

Table G-1 (continued)

Sex	Age	Education	Income	Dummy Variables to Denote Survey Version	Bidding vs. Non-Bidding Game Dummy	Length of Residence	Attitude Index[1]	Attitude towards cost Dummy	User Dummy	Water Quality Rating Dummy[2]	Dummy variables to denote Interviewer	Dummy variables to denote Profession	Dummy Variables to denote SIC Industry
X	X	X	X		X		X				X		
								X					
X	X	X	X		X		X		X		X		
								X					
X	X	X	X		X								

[1]This index was constructed by adding responses to various attitudinal questions.
[2]See question number B-l-b in the survey questionnaire.

Table G-2. Independent variable combinations used in all 43 outdoor recreation survey sites.
Dependent variable LN (visits).

Travel Time Cost	Mile Cost	On-Site Cost	Travel and Mile Cost	1/3 Travel and Mile Cost	Site and Travel and Mile Cost	Site and 1/3 Travel and Mile Cost	Site and Travel Cost	Recreation-Importance Dummy	In-come	Income Squared	Day Dummy[1]	Day Travel Cost Dummy[2]	Age	Sex	Hour Dummy[3]	Hour Site Cost Dummy[4]	Race Dummy[5]	Day Site Cost Slope Dummy[6]
x	x	x																
x	x	x											x					
x	x	x												x				
x	x	X						x										
x	x	x									X							X
X	x	x									X		x					X
x	X	X									X			X				X
X	X	X						x	(		X							X
x	X	x								X								
x	X	x								X			X					
x	X	x								x				x				
X	X	X						x	(	X								
X	X	x							(	X	X							X
x	x	X								X	X		X					X
X	X	X								x	x			X				X
X	X	x						x		X	X							
		x	x						(	X					x	X		
		X	X						(	X			X		X	X		
		X	x						(	x				x	x	x		
		X	x					x		X					x	x		
		x	X							x		X			X	X		X
		X	x							x		x	X					X
		x	X							x		X		X	X	X		X
		x	X					x		x		x			x	X		X
		x		X						X					x	X		
		x		x						X			X		x	X		
		x		X						x				x	x	x		

(continue

Table G-2 (continued)

Travel Time Cost	Mile Cost	On-Site Cost	Travel and Mile Cost	1/3 Travel and Mile Cost	Site and Travel and Mile Cost	Site and 1/3 Travel and Mile Cost	Site and Travel Cost	Recreation-Importance Dummy	In-come	Income Squared	Day Dummy[1]	Day Travel Cost Dummy[2]	Age	Sex	Hour Dummy[3]	Hour Site Cost Dummy[4]	Race Dummy[5]	Day Site Cost Slope Dummy[6]
		x		x				x	X	x					x	x		
		x		x					x	x		X			X	x		X
		x		x					x	x		X	X		X	x		X
		x		x					X	x		X		X	x	x		x
		X		x				X	x	x		X			x	x		X
X	X	X						x	X	x			x	x			x	
					x			X	x	x			x	X			X	
						x		X	X	x			X	X			x	
	X						x	X	x	X			X	X			x	
		X	x					x	x	x			x	X			x	
		x		x				X	x	x			x	x			X	
x	X	x						x	x	x			X				X	
					x			X	x	X			x				X	
						x		x	x	x			X				X	
	X						x	x	x	x			X				X	
		X	x					X	x	x			X				X	
		X		x				x	x	X			X				x	
X	x	x						x	X	x			X	X				
					X			x	x	x			X	x				
						x		x	X	X			x	x				
	x						x	x	x	x			X	x				
		x	x					x	X	x			x	x				
		x		x				x	X	X			X	X				
X	x	x						x	x	x				X				X
					x			x	X	X				x				x
						X		x	x	x				x				X
	x						X	X	x	X				X				X
		X	x					x	X	x				x				X
		x		x				x	x	X				x				x
X	x	X							x	x			x	x				X
					X				X	X			X	x				x
						x			x	x			x	x				x
	X						x		x	X			x	x				x
		x	X						x	x			x	x				x
		X		X					X	x			X	x				x
			x						x	x								
x	X								x	x								

(continued)

Table G-2 (continued)

Travel Time cost	Mile cost	On-Site cost	Travel and Mile cost	1/3 Travel and Mile cost	Site and Travel and Mile cost	Site and 1/3 Travel and Mile cost	Site and Travel cost	Recreation-Importance Dummy	In-come	Income Squared	Day Dummy[1]	Oay Travel cost Dummy[2]	Age	Sex	Hour Dummy[3]	Hour Site cost Dummy[4]	Race Dummy[5]	Oay Site cost Slope Dummy[6]
			X						X				X					
X	X								X				X					
				X					x				x					
			X						X					X				
X	X								X					X				
				X					X					X				
			X					X	X									
X	X							X	X									
				X				X	X									
			x						X		X							
X	X								X		X							
				X					X		Y							

1 Intercept dummy equal to one if the respondent stays one or more days and zero otherwise.
2 Slope dummy calculated by mu' tiplying day by travel cost.
3 Intercept dummy equal to one if stayed less than one hour.
4 Slope dummy calculated by mu tiplying hour by site cost.
5 Intercept dummy equal to one if white and zero otherwise.
6 Slope dummy calculated by mu' tiplying day by onsite cost.

Table G-3. Independent variable combinations used as tailored models for a subsample of the 43 outdoor recreation survey sites. Dependent variable is LN (visits).

Travel Time cost	Mile cost	On Site cost	Travel & Mile cost	1/3 Travel & Mile Cost	Recreation Importance Dummy	Income	Income Squared	Day Dummy	Day Travel Time Plus Mile Cost Dummy 1	Age	Sex	Camping Dummy
X	X					X						
X	X					X					X	
	X							X				
X	X				X	X		X				
X	X				X	X						
							Y					
X	X					X	X	X				
			X			X			X		X	
			X		X	x			x			
		X	X		X	X					X	
									X	X		
		X	X		X	X			X			
			X		X	X						
			x		x	x				x		
			X		X			X				
					X	X				X		
			X			X				X		
		X	X			X	X		X			

(continued)

Table G-3 (continued)

Travel Time cost	Mile cost	On Site cost	Travel & Mile cost	1/3 Travel & Mile cost	Recreation Importance Oummy	Income	Income Squared	Oay Dummy	Day Travel Time Plus Mile Cost Dummy 1	Age	Sex	Camping Dummy
			X			X	X		X			
		X						X				
			X			X			X			
			X				X		X			
			X			X	X			X		
				X		X					X	
				X		X		X			X	
				X	X	X						
				X	X	X		X			X	
				X	X	X						
				X		X	X	X				
				X		X						
				X		X		X		X		
				X		h		x		h		
			X			X			X	X	X	X
X	X				X			X				
X						X				X		
X	X					X		X		X		
X	X							X				
		M				X				X		
X	X	X				X		X				
		X	X			X				X		
			x						X	x		
X	X					X					X	

‘interceptdummy equalto one is respondent engaged in camping.